AGRICULTURAL AND TRADE CONFERENCE, MADRAS.

DECEMBER 1914.

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PREFACE.

The thanks of all members of the Agricultural and Industrial Departments are due to all those gentlemen, who whether connected with leading firms or with agricultural interests attended and assisted in the discussions at the Agricultural and Trade Conference in December 1914. In accordance with their suggestions the papers relating to that Conference are now issued in book form. The opening speech of His Excellency the Governor of Madras is printed first and explains the object and methods of the Conference. All papers under each subject head are then collected together on an ordered plan, *e.g.*, first the names of those who attended the meeting, secondly the notes prepared for the use of those invited to be present and thirdly the summary of the discussion which ensued.

D. T. CHADWICK,
Director of Agriculture.

January 1915.

CONTENTS.

		PAGE
1.	His Excellency the Governor's speech	1
2.	Cotton	7
3.	Groundnut	35
4.	Wool	48
5.	Manures	53
6.	Implements	94
7.	Well irrigation by power	109
8.	Jute	123
9.	Coconuts	130
10.	Tobacco	137
11.	Sugar	141

AGRICULTURAL AND TRADE CONFERENCE, MADRAS.

HIS EXCELLENCY THE GOVERNOR'S SPEECH.

Gentlemen,—In the first place, let me thank you heartily for the ready response which you have made to my invitation to meet here together in conference with some of the officers of this Government who are engaged in the development of agriculture and industries. It would perhaps be well for me to explain at the outset the idea underlying the summoning of this meeting which is the first one of its kind ever held in this Presidency, and in that sense an experiment. Yet it does, I hope, but mark a stage in an ordered scheme of development and progress. During the last eight years substantial grants and much attention have been given by Government to the development of agriculture and the improvement of agricultural practice; and although the department has by no means yet reached its full strength and scope considerable success has resulted from its efforts. As far as this can be ascribed to any one cause it is due to the policy of sending trained men into the districts to get into direct touch with cultivators, to study their conditions and work upon their indigenous crops. It is claimed with good reason that under normal conditions the improvements already introduced and adopted by the ryots in the districts are worth to them more than a crore of rupees a year, and this, although hitherto work of this description has only been possible in some portions of the Presidency. On the other hand the growing of crops and the methods of cultivation are only a portion of the economic development of a country. It is through you and the firms you represent that our commercial crops are brought upon the world's market. None know so well as you the clash of interests between different branches of trade and commerce; yet few are in a better position to realise the benefits which flow from an established market for a recognised commodity, the need for products to be up to the sample, the advantages and difficulties of trading in bulk, and the openings and best markets for different products. Hence to advance the economic

condition of our country, to develop its material resources, to retain and establish its markets, in a word, to increase its general productivity, requires the co-operation of both the growers and the purchasers. Both the producers and the purchasers are interested. Better farming is better business, and the first and immediate test to be applied to all departments directly designed to work for the agricultural development of a country is not a philanthropic, but a material one, namely, are they promoting better farming and better business? Thus if the Agricultural and Industrial Departments are to be full of service to the ryots, it is essential that they shall be in close touch on the other side with the trading interests. While they do not claim or pretend to be in any sense a complete intermediary between the ryot and the purchaser, they are already in direct touch with many of the ryots in many places. They most readily acknowledge the help they have received from many of you gentlemen who are here today, both in advice and in active assistance in the districts; and now that there are grounds for believing that they are steadily gaining more and more influence with the ryots, this meeting has been summoned with the object of bringing them into closer touch with commercial interests, in the hope that by your advice and criticism their work and energies may be directed towards objects immediately profitable and useful, and that, as a result of the discussions which I hope will take place, mutual knowledge of objects, difficulties and limitations may be increased. They do not ask for your general commendation or tolerant sympathy; they would, I am certain, prefer criticism and discussion, and to encourage this it is proposed that separate meetings shall be held (according to the time-table which has been given to you) of those chiefly interested in the different staples of the Presidency. It is not intended to indulge in set speeches nor will the discussion of the various committees be open to the press, but a *resumé* will be prepared each evening and circulated among the members concerned. Statements on the various subjects for discussion from the point of view of the Department of Agriculture have already been distributed among you, and I do not propose to discuss them. As is inevitable with a department which is feeling its way, these statements show that different stages of development have been reached in the work on different crops. I trust that the discussions which will ensue may lead in some cases to better organisation in dealing with improved varieties, so that the advantages of quality and uniformity may be brought home to the ryot; that in others, *e.g.*, in manures and implements further

openings for trade up-country may appear to the mutual benefits of yourself and the ryot; and in the case of others on which it is contemplated to commence work, *e.g.*, coconuts, that these discussions may ensure work being commenced on useful and sound lines. In all business, organisation plays a dominant part, and many interests are interwoven; accordingly, representatives of the Bank of Madras, of the railways and of the co-operative department have been invited to be present. Also, I have asked to meet you a few gentlemen who have personally taken an active interest in agricultural and industrial improvement, and who, by following or assisting in the discussions may possibly derive or contribute ideas which again may ultimately be put into practice in their own villages or on their own land or in tracts where they possess influence or elsewhere. Without increasing the size of these meetings and so checking free and informal discussion it was obviously impossible from such a large and divers Presidency as ours to invite more than a very few such representatives.

The idea of holding this meeting took shape before the outbreak of the war and before any of those difficulties which have arisen therefrom were dreamt of. But although a period of financial and economic difficulty may not seem a fitting opportunity to discuss schemes of development, yet at such a time it behoves all interests to work together as far as possible and it is more than ever the duty of Government to endeavour to secure that whatever funds can be made available for this important work are wisely and usefully expended. Moreover, whatever the temporary effects of this war may be, we do not believe that it can permanently arrest the economic development and improvement of our Presidency. For the events of the last fifteen years show that our feet are firmly set in the path of material progress and that Madras is destined to come into still closer contact with the world's markets. In that period the value of exports from our ports has doubled, the earnings of the railways have vastly increased, the spirit of co-operation is now abroad, the standard of living has risen and you gentlemen have increased very largely the number of your agencies up-country and are thereby better fitted than hitherto to take part in discussions such as those we contemplate. It thus seems wise to endeavour to foster mutual knowledge amongst those directly engaged on this work.

It was in the pursuit of trade and commerce that Britain was first attracted to India and in the early records of the

East India Company references to trade and commerce predominate. Until recently cotton has held the pride of place among our Madras exports and it is interesting to note that it is just a hundred years since the Company sent an American planter to Tinnevelly with the first cotton saw gin. The earliest efforts were directed towards the introduction of American cotton into India, and in 1840 ten planters from the cotton States of America were brought to India to foster its introduction. Three were allotted to our Presidency and were first stationed in Tinnevelly. Within a very few months they had left for Erode and within they ear they had reached Coimbatore. Attempts to introduce American cotton into this Presidency were continued for some years but all failed. But the main idea that the economic salvation of the country was to be found in the wholesale introduction of exotics held the field for many years. It is right to look upon the agricultural department as one of the youngest of the departments of Government. But as a matter of fact it has existed in one form or another for sixty years. In that time it has had a very chequered career, periods of high hope have alternated with long periods of depression and almost of despondency. The department as now being organised differs, however, in two very vital points, from its predecessor. In 1854 when the attention of Government was seriously turned to agricultural improvement, the all-pervading idea was the introduction of foreign implements, foreign stock, foreign seed and the demonstration of the advantages thereof on a "model" farm. Thus sixty years ago orders were placed in England for a steam plough, threshing machines, winnowers, several iron ploughs and harrows, in fact for a full set of all the aids to capitalistic large farming of the west. After a short period of management by a Committee of amateurs a trained Superintendent was brought out from England to manage these strange implements on the "Model" farm at Saidapet. The Superintendent was in Madras for almost ten years before he toured at all and before he ever saw an up-country village. It was the same with their cattle and with their seed. The foundation of their herd was laid by some cows described as Aden cattle, because they were brought here in a ship which came from that place. So with seeds, exotics were obtained and sent to ryots or Collectors up-country with meagre instructions. All these efforts, however, did not end in failure. Where local demonstration was possible, and was systematically followed, some changes were established, *e.g.*, the introduction of Bourbon cotton into Coimbatore in 1820, the introduction of large iron ploughs into Bellary by

Mr. Sabhapati Mudaliyar in the seventies, the introduction of the iron sugarcane-crushing mill and the introduction of barley into the Nilgiris.

On the other hand, the policy which has been steadily developed during the last eight years has been to send trained men into the districts and as such trained men became available, to open local agricultural stations where exotics can be thoroughly tested whenever necessary, but which shall primarily and mainly be engaged on detailed and continuous work towards improving the quality, the yield and methods of cultivation of the indigenous staple crops of the Presidency. The facts, there learnt and tested, are then communicated and demonstrated to the villagers on their own land by trained and competent agents. More on this I need not say; except that the success already achieved promises well for the future and that there is undoubtedly a growing interest and spirit abroad in the districts towards agricultural and industrial improvement. The vital differences then between the old and the younger department are that attention is now in the first place paid to indigenous crops under the local conditions in which the ryot works, and the organisation and maintenance of a trained staff up-country. Thus it is that I said that I hoped that this, the first meeting for discussion with the commercial houses, will but mark a further step in an organised scheme of development, by bringing the Industrial as well as Agricultural Departments into still closer touch with the local conditions of that which directly affects all their efforts, namely, the markets for their produce. I refer, of course, to the purchasers of their produce as represented here today by the leading exporters and commercial firms of the Presidency. It may be, gentlemen, I venture to think that you are yourselves now in a better position than heretofore to take part in such discussions. The general march of events has affected you as it has affected the Government. In a large and authoritative book on Indian cotton published more than sixty years ago, there is a vivid account of the mixing to which our cotton was subjected, and to the number of hands through which it passed before reaching the port of shipment. The firms had then few agencies up-country and a letter written in the forties by a dealer in cotton is quoted in which he looked forward to the time when trading houses would possess better equipped local agencies. These have now been established not only for the cotton trade but for other commodities and the enlarged and more intimate experience of local conditions thus gained places you, gentlemen, no doubt in a better position for such discussion than hithertofore.

I trust that you may have no cause to grudge the time you have so readily consented to give and that from your help, advice, and criticism during these discussions, these young departments, Co-operation, Industries and Agriculture which with the Forest and Fisheries Departments are more particularly charged with the duty of conserving and developing the wealth and natural resources of the country, may derive strength and knowledge for further progress. A slight alteration has been made in the time-table by interchanging the hours allotted for sugar and coconuts. This is to enable representatives of the Industrial Department to be present at the discussions both on well irrigation and on sugar. It is not proposed to ask you all to re-assemble for a valedictory address, nor does it seem necessary to ask you to discuss in full meeting the results of each Committee. The various Committees are fully representative in themselves. Copies of the reports of each Committee will be communicated to each member. The first Committee to meet now is the one on cotton.

I.—COTTON.

COMMITTEE ON COTTON.

DECEMBER 14TH, 1914—11 A.M. TO 2 P.M.

Present :

The Hon'ble Mr. Ll. E. BUCKLEY, I.C.S., *Chairman.*

1. Mr. A. Alexander, Messrs. Binny & Co., Madras.
2. Mr. M. Lennon, Messrs. Binny & Co., Madras.
3. Mr. D. Miller, Messrs. A. and F. Harvey & Co., Tuticorin.
4. Mr. S. C. Tsolakidi, Messrs. Ralli Brothers, Madras.
5. Mr. H. P. M. Rae, the Bombay Company, Madras.
6. Mr. W. R. H. Wait, the Bombay Company, Adoni.
7. Mr. W. E. Winter, The Coimbatore Spinning and Weaving Mills, Coimbatore.
8. Mr. R. Stanes, Messrs. Stanes & Co., Coimbatore.
9. Mr. O. Steiner, Messrs. Volkart Brothers, Madras.
10. Mr. F. G. Warbrook, Messrs. Massey & Co., Madras.
11. M.R.Ry. S. T. Shunmukham Pillai Avargal, Diwan of Ettiyapuram.
12. M.R.Ry. A. Vittal Dass Sait Avargal, Tiruppur.
13. M.R.Ry. T. V. Nanjundayya Avargal, Tiruppur.
14. Rev. S. D. Bawden, American Baptist, Telugu Mission, Kavali, Nellore District.
15. M.R.Ry. V. C. Velliangiri Goundar Avargal, Coimbatore.
16. Mr. W. A. Cross, Traffic Manager, South Indian Railway.
17. Mr. Wathen, Traffic Manager, Madras and Southern Mahratta Railway.
18. The Hon'ble Mr. L. D. Swamikannu Pillai, Diwan Bahadur, Registrar of Co-operative Societies.
19. M.R.Ry. A. Vedachala Ayyar Avargal, Assistant Registrar, Co-operative Societies.
20. Mr. K. T. B. Tressler, Director of Industries.
21. M.R.Ry. J. Narayanamurti Avargal, Personal Assistant to the Director of Industries.
22. Mr. D. T. Chadwick, Director of Agriculture.
23. Mr. R. C. Wood, Principal, Agricultural College, Coimbatore.

24. Mr. H. C. Sampson, Deputy Director of Agriculture, Southern Division.
25 Mr. G. R. Hilson, Deputy Director of Agriculture, Northern Division.
26. Mr. G. D. Mehta, Deputy Director of Agriculture, Central Division.
27. Mr. R. Thomas, Probationary Deputy Director of Agriculture.

AGENDA.

I. Suitability of the types of cotton which are being introduced whether—

(*a*) for export, or
(*b*) for local consumption.

II. Criticisms and suggestions on present methods of testing the value of types and of spreading those types.

III. By what means is it possible for the trade to assist in the establishment of suitable types, *e.g.*—

(*a*) by ginning separately consignments from certain villages ;
(*b*) by developing relations between the Agricultural Department and the grower ;
(*c*) by helping to see that suitable strains reach markets suited to them ;
(*d*) by giving an enhanced price for quality, if so, on what scale must a particular type be grown before this is possible.

IV. Whether it is desirable or possible for the Trade and the Agricultural Department working together to do anything towards helping to grade produce more satisfactorily, *e.g.*—

(*a*) organising auction sale in known markets ;
(*b*) by firms making a heavier deductions for bad ginning or mixing or the reverse giving a small premium for good ginning and purity ;
(*c*) by firms making advances on crops grown pure, to be inspected when on the ground ;
(*d*) by bringing about a closer association between the producers and consumers, as for instance by organising the latter to sell directly to the firms or otherwise.

V. How the trade can best be kept in touch with the work of the department—

(*a*) in local areas,

(*b*) more generally.

VI. In what ways cotton may deteriorate in value after leaving the grower and before reaching the consumer, *e.g.*—

(*a*) by mixing;

(*b*) by adulterating;

(*c*) by watering;

(*d*) by bad ginning;

(*e*) by grading up bad samples;

What action, if any, is necessary to try to counteract these?

VII. Are small ginning factories to be encouraged, and if so, is any inspection of ginning factories desirable and, if so, on what lines?

VIII. Is the cotton which comes from any particular locality damaged in value by bad or careless picking, prevalence of insect-pests, etc., and if so, can any suggestion be made to remove these defects?

IX. How can statistical returns be improved to be of more use to the trade?

X. Any other criticisms or suggestions?

NOTE ON COTTON IN THE NORTH OF THE PRESIDENCY.

There are three tracts where cotton is grown in the north of the Presidency and the cotton from each is known separately to the trade as "Westerns," "Northerns" and "Cocanadas."

2. The "Westerns" grown in the Bellary, Anantapur and West of Kurnool districts as well as in the Hyderabad State, are a mixture of varieties belonging to the species of Gossypium herbaceum and Gossypium indicum. The proportion of this mixture, although the seed is mixed, varies each year with the season; as it depends on whether the rains are late or early which variety predominates.

3. The "Northerns" which are grown in the Kurnool and Cuddapah districts are also a mixture of Gossypium herbaceum and Gossypium indicum, the former being known to the trade as "White Northerns" and the latter as "Red Northerns." The former is Gossypium herbaceum and is a true black cotton soil variety. The latter is the Gossypium

indicum and is preferred for growing on red soils. The "Cocanadas" are grown in the Circars chiefly in the Guntūr, Kistna districts and in the Upland taluks of Gōdāvari. This is also a mixture of varieties including Gossypium indicum, Gossypium obtusifolium and Gossypium herbaceum. No work has been done by the department on cotton in this tract.

Westerns.

4. In the "Westerns tract" two agricultural stations were opened by Government, one at Bellary, intended primarily for improving the cotton crop, and the other at Hagari, which was started with the idea of testing the possibilities of irrigating black soil from the Hagari river. The Bellary Agricultural Station was closed in 1912 and the work was transferred to the Hagari Agricultural Station, where the land available was much more suitable for experimental work.

5. In the early days of these stations local varieties were tested and grown alongside those introduced from the other parts of India, which included indigenous Indian cottons as well as exotics such as Dhawar American and Gossypium hirsutum from Afghanistan. Of all the varieties only two are now retained and except for these the cottons now under investigation are all strains of the local cottons. These strains were obtained as follows. In the first place it was necessary to eliminate from the crops grown on the agricultural stations all plants of the undesired species, in most cases indicum. This was done by removing each year all plants of that species which appeared. In a few years a stock of seed of practically pure herbaceum, the true black cotton soil variety, was obtained. This formed the basis for further selection work and at the same time formed the source from which demands for seed from outside were met. Actual selection was done by picking out single plants in the field; these had to be healthy, vigorous and prolific. The produce of these plants was picked separately and examined. After taking into account the length, strength, colour, uniformity and twist of the fibre as well as the ginning outturn a final selection was made. The seed of plants thus selected was sown out in rows and further selections on the same lines were made from these until uniformity of type was obtained. These were then grown on small plots to obtain a stock of seed sufficient to sow an area large enough to provide lint sufficient for a spinning test, on the basis of which selection could be made for distribution.

6. Experience has shown that cross fertilization in cotton is more common an occurrence than was supposed and the lines on which selection work is now being carried on have been altered accordingly. As before, healthy, vigorous and prolific plants will be chosen in the field, but instead of leaving the flowers to natural fertilization as many as possible will be self-fertilized. Again as before the produce of these plants will be picked separately and examined with regard to the length, strength, colour and twist uniformity and percentage of lint, only the best being chosen. The seed of these selected plants will be sown the following year in small plots and once again self-fertilization will have to be resorted to. Because though the plants in each plot may be of uniform type, *i.e.*, habit of growth, time of flowering and time of ripening of bolls, the produce may not be; and therefore cross fertilization within each plot will have to be guarded against. There are now three possibilites to be considered :—

(1) The several plants in a plot may not be of uniform type.

(2) The plants may be of uniform type, but the produce may show great variation.

(3) Both plants and produce may be uniform.

In the first case the plot will be treated as a field and selection will start again from the beginning.

In the second case only the plants with the best produce will be retained. These will be sown in separate plots, self-fertilization will again be carried out and the plots found to have uniform produce retained.

In the third case the seed of all the plants will be mixed and sown out in a larger plot. This plot will be separated, as far as possible, from neighbouring selections and the intervening space between it and them will be occupied by another crop. Picking for seed will be done from the middle of the plot only. This plot should give enough seed to sow in the next year another plot similar to itself, which will be similarly treated in order to keep the strain pure, and to test the selection along with others under experimental conditions, the main point to be elucidated being the yielding quantity of the selection. This will take two or three years to test. The best of the selections will then be grown on a large enough scale to provide material for a spinning test and on the results of this one will be chosen for distribution.

7. The history of a selection finally distributed will, provided it is of pure strain at the first, be very much as follows.

First year, single plant, self fertilized.
Second year, small plot do.
Third year, large plot, natural fertilization (cross fertilization with other selections guarded against).
Fourth year do. do. and experimental plot (seed discarded).
Fifth year do. do. do.
Sixth year do. do. do.
Seventh year, field scale (and spinning test).
Eighth do. and seed farm.

8. *Seed Distribution.*—Distribution of seed began first at Bellary in 1906-07; but in 1910-11 this work was transferred to Hagari. The seed distributed was the surplus stock of "farm" seed, *i.e.*, the produce of seed originally obtained in the bazaar but grown on the farm and rogued-of indicum plants for a number of years. The quantities sold were never large; at this station the greatest quantity sold in any one year was 5,000 lbs.; but the seed usually found a ready sale at prices varying from 6—20 per cent., above the local rate, though all that was claimed for it was that it was fresh and good and that the cotton obtained by growing it was white.

9. This distribution, therefore, was strictly limited; but in 1912-13 cotton was grown on contract by ryots for the department. Under this agreement seed is supplied free to the ryot who sows it unmixed with his own, cultivates it cleanly, picks the crop and carts the kappas to the agricultural station. The Government agrees to pay the assessment on the land and to pay the local market rate on whatever date the ryot chooses to appear and claim settlement. He is given until the end of August to do this. This form of agreement was subsequently altered as the ryots claimed that, as the cotton gave a higher ginning outturn, they were the losers and they did not consider that the payment of the assessment more than covered the difference. A clause was therefore added to the agreement as follows:—"but for every maund of lint above 25 per 100 maunds of kappas at which his produce gins he is given Rs. 6."

10. The cotton now being issued to contract growers is selection No. 1.* This has a ginning outturn of 27 per cent. and the following are reports on it:—

Report by the Buckingham Mills Co. (Limited) made in 1909: "A very good sample fully $\frac{5}{8}$ inch long and very strong, colour very white which increases its commercial

(* Sample shown.)

value. A further report on this by the same company in 1911—

"No. 1 is very similar to No. 2 in length of staple and colour. The test for this is count 33s, pull 40 lb. The loss through the blow room is 11 per cent." No. 2 report is as follows:—"The sample No. 2 is, I think, the best the result of this is count 33s, pull 44 lb., the staple is fair $\frac{7}{8}$ inch and is of a very good white colour; the loss is 11 per cent. The sample is very free from leaf."

11. This same cotton was valued by the Imperial Cotton Specialist in 1912 as equal to the best class of Westerns and priced at Rs. 275 a (Bombay) candy with Kumptas at Rs. 290.

12. Samples sent to the Imperial Institute, London, were reported on as follows, dated March 31, 1913:—

Description.—Ginned cotton clean, slightly leafy, fine, rather harsh, of moderate lustre, and varying in colour from pale reddish brown to pale cream with many small yellow or brownish stains.

Strength.—Fair.

Length of Fibre.—From 0·7 to 1·2 inch; mostly from 0·8 to 1 inch.

Commercial Valuation.—The sample was classed as 'about fine' and valued at 6½ *d.* at the time.

'Fine' Broach was	6 $\frac{9}{16}$.
Good Kumptas	6 $\frac{3}{16}$.
Midd. American	6·80.

It is expected soon that it will be possible to give out a better cotton with a ginning outturn of 30 per cent. Several other strains have been selected and are now under trial. The best of these compare favourably with fine Broach.

13. The following shows the distribution of cotton seed by the department in the "Westerns" area:—

1910–11	2,000
1911–12	6,000
1912–13	5,000
1913–14	6,000 (Selection No. 1.)
1914–15	52,000 sufficient for 5,200 to 6,000.

NORTHERNS.

14. In the "Northerns" area Government opened an Agricultural station at Nandyal in 1906, with the main object of improving the cotton crop of the tract. The

problems here were very similar to those in the "Westerns" area and preliminary trials of local cotton obtained from selected villages in the Nandyal valley were made at the Bellary Agricultural station before the Agricultural station at Nandyal was opened. Two main types of cotton were found, viz., the "Tellapathi," Gossypium herbaceum and the "Yerrapathi" or the Gossypium indicum. Of the former which is the true black cotton soil variety, two strains were found, namely, the local cotton and the "Gadag" cotton. This latter was periodically introduced into the district from the Gadag district of the Bombay Presidency and is the "Kumptas" of Bombay. It is also known in Kurnool by the name of "Maddikeri."

15. These two cottons were compared on trial plots on the Agricultural station and it was found that as far as yield and ginning outturn were concerned the local herbaceum was superior to the "Gadag" while at the same time it was more drought resistant. Samples of the lint of these were sent for report to the Carnatic Mills, Limited, and their report which is as follows shows little difference in the two cottons:—

"The Gadag cotton was very good and strong staple; clean and carefully picked, lost only 8·6 per cent. 20*s* yarn spun from this cotton alone tested 84 lb."

"The sample of Northern cotton is very good. The staple is about $\frac{3}{4}$ inch long and very regular. The colour is good and the cotton is very free from impurities; we have tested it to spinning and it works well. In the scutching and carding it was very spongy. The average test for strength is 19·60 counts tested 83 lb.

"There is very little difference in the two samples but Gadag is slightly superior to Tellapathi.

"Both samples are superior to the ordinary Nandyal cotton we are receiving from our press owing to the samples being of one variety of cotton."

16. As, however, the first step in the improvement of Northerns was to improve the colour and as there was a considerable stock of these two herbaceum cottons which produced a very similar lint, which was superior to the cotton as then brought into the market from this tract, it was decided in 1909 under expert advice to mix these two samples and issue the seed for sale distribution to ryots.

17. In the meantime selection of single plants had been made in the same way as described for the "Westerns" area. These were mainly of the herbaceum type for improvement of the black cotton soil cotton but selections were also made

from a strain of indicum which gave a white lint and which would be suitable for distribution in the red soil tract. Except for these latter selections the cultivation of indicum cotton was given up owing to the frequency of natural cross fertilization, which had considerable influence on the quality of the herbaceum cotton.

Similar precautions have been taken to check the influence of cross fertilization here as has been necessary in the Westerns tract already described.

18. The main object of selection work has been to increase the crop and ginning outturn of these cottons and at the same time to improve the quality of the lint while maintaining the standard of colour.

19. The distribution of cotton seed was commenced from the agricultural station in 1909 and attempts were at the same time made to have this grown outside on contract. This, however, failed and for the next two seasons land was rented and cotton was grown for seed by departmental agency.

This, however, strictly limited the scope of work and in 1911-12 attempts, which proved successful, were again made to grow cotton on contract.

20. The agreement under which this was grown was the same as that detailed for the western tract but this had to be subsequently altered owing to the same reason, namely, the higher ginning outturn of the "Sircar" cotton.

21. The following figures show the quantities of seed distributed. This has been sold at rates 20 per cent. higher than those prevailing locally for seed.

		LB.	
1909-10	... ...	3,000	(grown on the Agricultural station).
1910-11	... ...	19,000	(grown departmentally).
1911-12	... ...	34,000	(do.)
1912-13	... ...	70,000	grown on contract.
1913-14	... ...	35,000	do. Sufficient for 3,500 acres (The season was very unfavourable otherwise 100,900 lbs. at least would have been sold).

The crop grown by contract growers in 1913-14, *i.e.*, the seed this year distributed is a single plant strain (No. 2) which has a ginning outturn of 30 per cent. (sample shown).

22. The following are reports on this strain :—

Report from the Buckingham Mill Company (Limited), dated 17th August 1911, "staple $\frac{3}{4}$" fairly strong, clean and good colour will lose 6 per cent.

Report received from Imperial Cotton Specialist, dated 8th October 1912.

Valuation Rs. 310 a candy (Bombay) with Kumpta at Rs. 290.

Report received from Messrs. Tata Sons & Co., Bombay, dated 24th February 1914.

"This cotton is very clean, being almost free from leaf and is creamy white in colour. It may be classed as superfine. The staple is weak and variable. The fibres being long and short mixed, in appearance it approaches fine broach. On the basis of "fine broach" which is quoted to day at about Rs. 285, we value this cotton at about Rs. 290 per candy of 785 lbs., Rs. 5 being allowed for superfine class."

CAMBODIA COTTON:

23. So far no selection work has been done on this cotton in the north of the Presidency, mainly for lack of room. With the extension of Samalkota farm and the opening of the new farm at Sirvel, however, it is hoped that a start will be made.

24. As regards distribution, work has been simple. At first seed was obtained from the south but latterly the produce of local crops has been bought and ginned by the farm officers. This was distributed by the district officers, who showed samples of the kappas to the ryots, explained how the crop ought to be grown and offered seed for sale. The crops sown were inspected later in the season and further instructions given. This work was begun in 1910–11 when about 1,000 lbs. of seed were disposed of; in the following year seed was more widely available of and few demands for seed came in. Altogether 2,500 lbs. of seed were distributed. By 1912–13 the cotton had got fairly well-known throughout the tracts (chiefly the Ceded Districts) where the department had been working and 12,000 lbs. seed were distributed. Last year (1913–14) demands were not great as the seed already in these tracts was almost sufficient to meet all demands. Endeavours will be made in the future to extend the cultivation of this crop in the Circars, where there seems more chance of its keeping its good quality than is the case in the Ceded Districts, which seem to be too dry for it; and to get the ryot to take more care in its cultivation, more particularly with regard to sowing pure seed. With this object in view, supplies of pure seed will be maintained at the various stations in the division.

COTTON IN THE SOUTH OF THE PRESIDENCY.

25. *Varieties of cotton and their distribution.*—The variety which predominates is known as uppam or ukkam. This is the main variety found on the black soils of Coimbatore, Salem, Trichinopoly, South Arcot, Madura and Rāmnād.

26. The other black soil variety is karunganni which is now the predominating variety in the Tinnevelly district. This, or a variety closely resembling it, is also found to some extent in the black soils of Trichinopoly, Salem and South Arcot where it is known as ladam.

27. The following are expressions of opinion and valuation of the lint of these two varieties:—

Liverpool valuation, 12th February 1908, made for the British Cotton Growing Association.

Karunganni season picking.—"Fine" very clean and bright, value 5½d.

Karunganni summer picking.—"F.G.F." not so clean and bright as the above, value 5⅜d.

Uppam (Tinnevelly), season picking.—"Good" very good colour, staple very short, value 5¼d.

Uppam (Tinnevelly), summer picking.—"Good" light brown in colour, staple very short, value 4¾d.

28. Great difficulty was experienced in getting these samples valued at Liverpool and the Chairman of the British Cotton Growing Association wrote as follows:—"We have "approached several brokers in Liverpool and not one of "them would take the matter up, as you know Indian cotton "is very little used now in this country and consequently "there are very few men who understand it."

Messrs. Binny & Co., in 1909 made a spinning test of ordinary karunganni with the following result:—Loss in weight in the scutches 9·5 per cent. counts 19·60, testing 51 lbs.

29. In 1911 samples of uppam and karunganni were sent to the Imperial Institute, London. The following is the result of this examination:—

"The comparative examination of the uppam and karun- "ganni constituents of Tinnevelly cotton has shown that the "former variety is of much coarser staple than the latter, the "average diameter being, respectively, ·00084 inch and ·00074 "inch. The karunganni is thus seen to approximate in fineness "to Egyptian cotton while the uppam has the ordinary coarse "character of most Indian cotton. In other respects, the "sample of karunganni is little, if at all, superior to the uppam. "It appears, however, from the information supplied by the

"Deputy Director of Agriculture that the growth of karun-
"ganni has been unfavourably affected by the weather."

The following is the summary of the examination :—

	Uppam.	Karunganni.
Description.	Clean, harsh, fairly lustrous, of white to pale cream colour and almost free from stains.	Clean, somewhat harsh rather dull, of cream colour and free from stains.
Strength.	generally Good ...	Good.
Length of fibre.	·9 to 1·1 inch ...	·8 to 1·1 inch, mostly ·9 to 1 inch.
Diameter of fibre.	From ·00065 to ·0012 inch, average ·00084.	From ·0006 to ·0010, average ·00074.
Microscopical characters.	Fibres examined were fully matured.	Fibres examined were fully matured.
Commercial valuation.	$6\frac{1}{4}$d. with "Good" Tinnevelly at $6\frac{5}{16}$.	About $6\frac{1}{4}$d. with "Good" Tinnevelly at $6\frac{5}{16}$.

Opinions on samples of uppam and karunganni shown to buyers in the south for spinning have been invariably in favour of the latter.

30. The Koilpatti Agricultural Station which is situated in the centre of the "Tinnevelly" tract was started by Government mainly with a view to the improvement of the Tinnevelly cotton and up to the present this is the only Agricultural Station in the southern districts suitable for the conduct of this work.

31. Early work in plant selection showed that there was much more variation in the Karunganni variety than in the Uppam and this combined with its superiority have led to work being confined to the improvement of this variety.

32. Selection for the improvement of karunganni cotton has followed two methods : (1) a bulk selection, (2) selecting each year plants of a definite uniform habit from which seed is collected separately for sowing.

33. The following are spinning reports by the Tinnevelly Mills on the produce from the bulk selections :—

"*28th August* 1913.—The cotton in the bales is very
"clean and exceedingly free from broken leaf and stained
"dead fibres. The two tests taken through the blow room
"gave a loss of $7\frac{1}{2}$ per cent. to 7 per cent., respectively. The
"fibres seem very even and although perhaps of a rather more
"creamy colour than Tinnevelly cotton, the cotton has a silky
"appearance which makes it look quite white. We took it
"through the ring frame and spun it along with our ordinary

"20s. The result was for the same counts an average "strength of 58 lbs. against our ordinary 20s of 50 lbs. The "yarn is very even, very clean and is an exceedingly good "20s yarn. Comparing the tests with past tests of Tinne-"velly and Cambodia, the Karunganni seems to just come "between the two in point of strength, but is superior to "both in other respects."

34. The following is a spinning report received from the Tinnevelly Mills this year of this Karunganni cotton grown by ryots and machine ginned at Messrs. A. & F. Harvey & Co.'s agency at Satur :—

"We have taken tests of the first two lots of Karun-"ganni cotton from Satur. The second delivery looked "much nicer and cleaner in the bale being more free from "leaf. We enclose herewith the results of our test through "the blow room first lot lost 8 per cent. and second lot lost "8 per cent. We spun it into 20s yarn. . . . . Both "lots came out alike in strength, colour and evenness. The "cotton makes a very nice, white and even yarn and the "strength is certainly above the average of any cotton we "are using with the exception of Cambodia . . . . The "cotton is certainly a very great improvement on the Tinne-"velly we get at present."

35. The other method of selection is by unit strains. An individual plant is selected and its kappas is examined and given marks for (1 natural twist of the fibre, (2) evenness in length of the fibre, (3) fineness. The length of the fibre, the yield of kappas and the ginning outturn is also ascertained.

The seed obtained from such plants, which pass muster, are next year sown in separate plots, each plant being given 2′ × 2′ space so that each plant has as far as possible similar conditions of growth. From the crop raised, a certain number of plants are selected and the kappas from these is separately collected. Attention is paid to the shape and habit of the plant. The ripening habit of the strain is also noted by means of periodic pickings of kappas. The crop from these marked plants is again examined individually and a further selection is again made the following year. This continues year after year until a type is fixed which possesses the characters required. When this stage is attained the seed from several plants of the same selection which have similar characters in all the points mentioned above, are mixed and sown in a 5-cent. plot under ordinary, or as far as possible ordinary, field conditions. From this

test those which do not promise well are rejected and the rest are the following year grown on acre plots under actual field conditions. Here further strains if necessary are weeded out. The following year those retained are grown by contract growers on areas of 15·20 acres and the lint obtained is sufficient for proper spinning tests under factory conditions. Though this Agricultural Station was started in 1904 it was not until 1908 that it was possible to commence this work and it was only in 1912--13 that one strain has reached its final stage.

36. The following is a report on the spinning of this strain received last year from the Tinnevelly Mills.—

" *Company No. I.*—It was very clean in the bale and " the test of 100 lbs. from each bale showed a loss of 6 per " cent. and 5·5 per cent., respectively. The carding showed " it to be particularly free from nep and leaf. We spun it " into 20s yarn and the spinning was excellent. The resultant " yarn when tested for strength gave as follows :—76, 57, 58, " 68, 60, 83 and 61. Average strength 65 lbs. When tested " for evenness it showed us a splendid yarn. Taking the test " made in comparison with the test made in August (bulk " selection karunganni) we have no hesitation in saying that " the cotton is much superior in evenness of staple and " slightly stronger but the colour of the two is identical. It " is a nice silky cotton and although of a slightly creamy " tint, the yarn looks very white and is a satisfactory yarn " in every way."

37. The following is the report made this year :—This indicates better the value of the cotton as the tests were made to see what the cotton was capable of spinning up to. Mr. Steel of Messrs. A. & F. Harvey & Co., was of opinion that it would spin up to 40s.

38. The following is the result of a test made at the Tinnevelly Mills in spinning 40s yarn.—The spinning master writes. " I ran a special test through of this cotton and spun it into 40s yarn. I must say that the yarn far exceeded my expectations. Blow room test showed 7·8 per cent. loss. It is a very nice even yarn indeed and the strength test is every bit as good as Cambodia, viz., 36 lbs. with the same production. It spun exceedingly well and if all this type of cotton is like the sample we tested, I should say it was superior to Cambodia. The colour is excellent and compares very favourably with yarn we spun from pure American cotton being far whiter than Cambodia."

Subsequently Mr. Osborne, Messrs. A. & F. Harvey & Sons, agent at Virudupatti, wrote. The Spinning Master, Tinnevelly Mills, says "that this quality (Company No. 1) is better than any of the others as regards strength and colour and that the mill is now getting splendid results from it in spinning 50s."

39. Spinning tests were also made this year by the Tinnevelly Mills of six other strains 40s yarn being spun in the case of 5 and 44s in the case of the 6th.

[*N.B.*—Samples of these cottons and yarn on show.]

40. The results are all very similar and the following are remarks made on two which have been retained :—

Company No. 2.—The Spinning Master of the Tinnevelly Mills reports :— "It was very clean in the bale and test through blow room showed us 5·5 per cent. net "loss. I had it spun into 40s yarn and it makes an excellent "strong yarn. It is as good in every way as the 'A' type "(Company No. 1) with one exception, it is not quite so "white. It is as strong and seems quite as even in staple."

Company No. 3.—Mr. Osborne, Messrs A. & F. Harvey's Agent at Virudupatti, writes that the mills say that this "is a nice white clean cotton but not quite so strong as the other 'A' types sent for testing. It is suitable for spinning up to 44s. They tried to spin 50s but found the cotton unsuitable."

41. To understand the reasons why three types of cotton have been retained, it is necessary to know something of the agricultural conditions of the tract. In the north the season is a month to six weeks earlier than in the south. This means that the bulk of the season picking is completed before the hot weather really sets in. Hence a cotton is required which ripens evenly, *i.e.*, ripens its crop practically all at the same time. Company No. 1 has this character and the distribution of seed of this strain is now restricted to this tract where it is expected that it will replace the Uppam variety which on account of its even ripening habit predominates here. It has been tested in the south of this tract, but it has been found that it is unsuitable except in years when the sowing rains are very early. If sown late the crop will be in full young boll when the hot weather sets in, which causes bolls to drop before they have matured their cotton. This strain has a ginning outturn of 2-3 per cent. more than the ordinary Tinnevelly cotton.

42. *Company No. 2* is a cotton which ripens unevenly and therefore when the hot weather sets in, it can withstand its

effect much better than a cotton which ripens evenly, as it carries a comparatively small number of well-developed bolls at one time. This strain has been distributed all through the south. Last year showed this strain to be a very heavy cropper in a late season and as it has a ginning outturn of over 31 per cent. it is a much more profitable crop than the ordinary Karunganni which gins at about 25 per cent. on an average. It has the additional advantage that on account of its uneven ripening it does not become entirely exhausted after the season picking. In the south the ryots depend considerably on the summer picking which is dependent on the thunderstorms of April-May. In the north these rains are seldom sufficiently dependable and hence ryots there are not particular whether the variety gives a good summer picking or not.

43. *Company No. 3.*—Although it is not such good cotton as the other two, it is still a considerable improvement on the ordinary Tinnevelly being capable of spinning up to 44s yarn. This has been retained with a definite purpose, so far it has been found to be a heavy yielding strain, but its chief value lies in its high ginning outturn which is $33\frac{1}{3}$ per cent. Of recent years a cotton known under various names as "Mailam," "Malan," "Pulichai," "Vada" and even "American" has gained considerable favour in many villages. This is the white-flowered Jari cotton of the United Provinces. When this was first noticed the attention of all firms dealing in cotton, as well as the Tuticorin Chamber of Commerce, was drawn to this by the department. A joint note was then issued by all firms and published broadcast by means of leaflets stating that this was a very inferior cotton and no firm would buy it. The direct result of this was that dealers, in order to dispose of their kappas mixed it judiciously with Tinnevelly, and so were able to sell it without much trouble. Thus, instead of checking the spread of this cotton, the direct result has been that the whole quantity of seed at the gins contained more or less of this cotton and now this variety is to be found everywhere especially in the north of the tract mixed in varying degrees with the ordinary Tinnevelly crop. Dealers are encouraging the growth of this variety by making arrangements to collect seed of this pure and this year the price charged for this seed has been Rs. 20—24 per pothie which is nearly double the price of ordinary seed. This shows what a demand there is for this variety. There is thus a likelihood of there being an increasingly large proportion of this mixed with Tinnevelly cotton unless something can be done to counteract it and efforts are being made this season

to get persons to try this new strain from the Government farm, while seed farms also are being grown with it to provide seed for distribution in the event of its succeeding well.

44. It is possible also that the war will assist in ridding Tinnevelly of this cotton. None of the mills in the south will use it owing to its short, coarse and brittle fibre; and, as export is likely to be restricted, this will mean that the better samples will find a more ready market. The trade could by exercising more strict control of the buying do much to rid Tinnevelly and Rāmnād of this cotton.

45. Besides this Mailam cotton, there are in the southern districts two perennial cottons of minor importance. These are the Nadam and the Bourbon. These two varieties are both red soil cottons. They are principally grown, mixed together in varying proportions, in the east of Coimbatore, the west of Salem and the extreme north of Madura. The former is an indigenous cotton The lint is coarse, very variable in length, but in general very short and is regarded as of little value. The latter is an introduced cotton of excellent quality when well grown, but this is seldom the case. It is grown solely as a dry crop on the shallow red soils rich in lime and it will not pay to grow it in any other way. It yields very little kappas the first year and is at its best in the third year provided it has survived the very arid conditions which so often prevail in this tract. It and the Nadam are both a source of much injury to the better cultivated varieties of cotton, viz., Uppam and Cambodia in that they harbour and maintain many insect pests which would hardly survive if all cotton crops were treated as annuals.

DISTRIBUTION OF SEED.

46. The present methods that are adopted by the department to distribute seed and to maintain the quality of the cotton are as follows :—

The work of the department has until this season been practically confined to the middle and south of the tract, owing to the unsuitability of karunganni to the north of the tract. This year owing to the production of promising unit strains of an even ripening habit the work has been pushed out into the north. The department obtains its seed for distribution from seed farms raised by contract growers. The seed for sowing is supplied to these growers by the department which also supervises the sowing. The kappas of the season's pickings is bought in by the department, which gins it and issues the seed to village depots for sale,

These depots number some twenty to thirty and are arranged to supply to the whole area of the south. The seed is sold at a fixed price—this year at Rs. 12 a pothie of 247 lb. The depot is in charge of some responsible man in the village who sells the seed and keeps a register to whom it is sold, area to be sown, etc. For this he receives a commission of 8 annas per pothie sold. The seed supplied to these seed farms up till last year was that of the bulk selection, karunganni grown on the Koilpatti agricultural station. The area of these seed farms is strictly limited, viz., 400 acres and this supplies seed sufficient to sow 10,000—12,000 acres, which is from 4–5 per cent. of the total area under cotton in the tract suited to Karunganni. Last year about one-fourth of this seed farm area was sown with seed of a unit strain (Company No. 1) and this year about 60 per cent. of this area has been sown with seed of a unit strain (Company No. 2). The seed of Company No. 1 grown on seed farms last year has been this year distributed to depots in the north of the tract, *i.e.*, the Uppam area; and, in addition to the 400 acres of seed farm grown in the south, 75 acres are being grown in the north of Company Nos. 1 and 3.

47. The demand for departmental seed is very great and much greater than the supply and in the earlier years of distribution this had a considerable influence on the quality of the general crop. Within the last few years however the number of gins has very greatly increased, as not only have cotton firms increased the number of gins at their existing factories but new factories have been started. The result has been that a very much larger proportion of the cotton is now machine ginned and the hand gin is fast dying out. This has meant that the seed supply which formerly chiefly depended on the hand gin is now very largely dependent on the factory. The problem to be faced was—Should the department increase its seed farm area or should it aim at making the ryot more alive to the advantages of good seed and more dependent on his own resources. For the south of the tract alone 8,000 to 10,000 acres would have been required for growing the seed requirements of the crop. It was decided therefore not to increase the area of seed farm but to aim at getting villagers to co-operate and have sufficient kappas ginned to suit the requirements of the village. For this the co-operation of all ginning firms was sought and all agreed to gin separately all lots of kappas brought in by ryots for seed purposes. Three villages were induced to do this in 1912–13 and twenty in 1913–14, but the chief difficulty met

with is that at the time of ginning, the ryot can often get a better price for his kappas by selling to the dealer who buys from his village. The village dealer appreciates a good sample of kappas and does not mind paying more for it, as he can utilise this to grade up poor samples. Only one firm shows its appreciation of a good sample by paying more for it. The ryot ultimately gains by this co-operative ginning as he can sell his seed at sowing time at 50 per cent. and more above the value of the seed at the time of ginning, but he does not realise this at the time he is selling his lint. He reckons it up and finds that the local dealers' offer is better than what he gets for his lint and the current value of his seed and he saves himself a lot of trouble by selling locally in his own village. However this last year seed sufficient to sow 12,000 acres have been stored in these villages. It is to these villages that seed of unit strains are being sold. Company No. 2 which gins at 31·3 per cent. is being thus distributed in the south on condition that the kappas is ginned for seed. The 25 per cent. increase of lint to seed will however be probably sufficient inducement to do this. Further than this the demand for departmental seed is so great that depots for sale are now only opened on condition that the ryots arrange next season to take the kappas in for ginning for seed.

48. No work has been done in Coimbatore, Salem, Trichinopoly, or South Arcot except the encouragement of Cambodia by sale of seed. This however is no longer necessary as the local seed supply is now ample and many of the firms interested in this cotton are much stricter as regards quality of kappas than they are in the case of indigenous cottons. Thus good seed is available in large quantities. Selection work with unit strains has been commenced with Cambodia, but work has not yet reached that stage when results can be given.

Statistics.

49. Forecasts of sowings are issued on 7th August and 7th October and estimates of outturns on 7th December and 7th February each year.

50. In order to get more accurate figures of the movements of cotton, presses and mills are being requested to send each week to the Director of Agriculture statements of bales pressed, etc. (forms will be shown). These will be totalled for the different varieties and the totals published and communicated to the Director of Statistics, Calcutta. The figures from presses and mills will of course be kept confidential.

SUMMARY OF THE DISCUSSION ON COTTON.

Mr. Buckley opened discussion by inviting criticism on the types of cotton which the Department was endeavouring to put out in the different districts. Samples of these with the yarn spun therefrom were on the table. Northerns and Western, *i.e.*, those from Bellary and Ceded Districts were first considered. The representatives of the Buckingham Mills who are the chief local consumers of this type of cotton said that the samples recently put out from Nandyal answered their purpose very fairly well and were the sort of type of cotton that was required. On being asked to define their type a little more definitely, as Mr. Hilson had a selection on the Nandyal Farm which was similar in general type but a somewhat heavier yielder (which of course was most important from the point of view of the ryot) but was distinctly harsher in texture, they replied that the first requisite was uniformity then colour and strength. The fibre should be a good inch long in length and strong and after this as fine as possible—especially was improvement in fineness needed in Westerns.

This brought up the general question of what the firms considered formed a satisfactory test of the relative values of the different selections of cotton. Mr. Chadwick said that the Department had frequently sent small consignments to different judges even to Bombay, Poona or abroad and the opinions expressed had been divergent. The unanimous opinion was that an actual spinning test performed by local mills who are accustomed to deal with that class of cotton is far and away the most satisfactory test ; and the representatives of the mills in Madras, Coimbatore and Tinnevelly expressed their willingness to carry out any such tests for the Department at any time and stated that they could more readily accept each other's opinions thereon than the judgments formed by distant cotton experts on hand samples. The smallest quantity with which such a test could be made would be from 300 to 400lb. of lint or if different counts were spun more would be required. Mr. Vital Das Sait suggested that the aid of some of the Bombay mills should be obtained for testing finer counts ; but it was pointed out that Messrs. Harvey & Co. had already spun some of the selections into 40s and had even obtained 50s with others, samples of all these were actually on view on the table. Mr. Miller on behalf of Messrs. Harvey & Co., Tuticorin, also

stated that the cotton which was being put out in Tinnevelly district was a distinct improvement over that formerly obtained, but his complaint, in which he was supported by every representative present, was that there was not enough of it, to which Mr. Winter on behalf of the Coimbatore Mills and Mr. Vital Das Sait added that no work of this nature seemed to have been attempted in the Coimbatore district an important cotton growing tract. The general position was admitted but it was pointed out that for some years seed of known quality sufficient to sow each year over 20,000 acres had been sold annually; and that this had had some effect. But such expansion takes time, and to bring home to the ryot the monetary advantage of cultivating a good variety and of preserving the seed pure, it was necessary to get him into as close touch as possible with the market which especially required that grade of produce so that the full advantage might be reaped by him. It was true that even now the local dealer would sometime pay a little more for specially good lots of cotton in order to use it to grade up his inferior stocks; but such transactions did not bring home to the ryot the interest which a mill had in obtaining uniform samples of cotton in the same way as dealings directly with the firms' agents in which the latter were prepared to pay for quality nor did it help him to keep his seed pure. From the general discussions which ensured it became clear that whilst very small lots were of little use to any one whether spinners or exporters, yet spinners were, on the whole, more interested in smaller quantities than exporters. Unless practically the whole of the cotton of a whole district were graded up it is almost impossible for the exporters to place it on a foreign market as an improved strain. Although better cotton does normally mean a better price in the export trade, as elsewhere, yet consignments are so large that unless the special selection become established over a very large area it is impossible for them to differentiate the selected fibre, all the more so because it is difficult to ensure special lots reaching special mills abroad. The local mills, however, are in closer touch with the producers and are more interested in the various selections at an earlier stage in their history. Exporters did not object to mills being circularized about good strains of cotton which were being spread in certain villages or localities since by the time these strains got on a sufficiently large scale to be of interest to them they were bound to hear of them. The mills would in such cases like to have information regarding the latest tests to which such cotton has been submitted.

Mr. Sampson then explained the methods pursued by the department in spreading better seed. Seed of special strain was sown on contract for the department in Tinnevelly on over 400 acres and in Kurnool and Bellary on over 1,000 acres, each year. The department supervised the cultivation, bought all the produce, ginned it at their own gins on the farms, carefully sorted over the seed to pick out all poor or damaged seed and at next sowing season sold the selected seed at a number of village depôts throughout the tract. The depôts were under departmental inspection and the seed sold was actually used for cultivation purposes. These stocks of seed were always priced at least 10 per cent. above the village rates and were practically always sold out entirely every year. In the days in which much of the cotton was ginned by small hand gins in the villages there was a good chance of seed thus distributed being kept fairly pure from year to year; but with the growth of the system of taking the kappas to large ginneries the danger of the villagers getting back mixed seed was greatly increased, and in Tinnevelly attempts had been made with considerable success to induce those villagers whom the department knew had cultivated pure a better strain of cotton to take the produce jointly direct to the large ginneries, the Managers of whom made special arrangements for ginning it promptly and separately from any other consignment and for returning the seed immediately to those villages. This had proved to be profitable to the villagers and more villages had taken it this year than last. It was hoped ultimately to get such villagers to join together in co-operative associations for carrying on such work. Mr. Chadwick read an extract from a report which he just received on the working of one of those societies which showed that the members had made an additional profit of about Rs. 4 an acre by thus working together and dealing direct with the firms. They also had their stock of pure seed for next year. The representatives of all firms present stated their readiness to gin such consignments separately with a view to preserving the purity of the strain of cotton. But they were not prepared to express any opinion on the possibility of such societies becoming general and effective working agencies in cotton trade. The Bombay Company expressed the opinion that good results would be most quickly obtained if Government could take over the whole of the seed supply for any special area. The area cultivated in Tinnevelly formed a suitable tract for such enterprise. It is compact and distinct and not excessive in area. Mr. Chadwick said that this would mean the management of about 10,000 acres of seed farms every year, to which

the answer was given that that ought not to be beyond the power of organisation. Other suggestions were that vendors of cotton seed should be licensed, their stock inspected and control exercised over them. It was feared, however, that this last suggestion was hardly practicable as so much cotton seed is used for fodder, etc., there are a large number of dealers in it and it would mean a very violent interference with the methods of village trade. Another suggestion put forward was that the Egyptian methods should be copied in Madras. But the two countries had developed on such different lines that it was impossible and inadvisable to introduce into India that degree of Government interference which existed in Egypt. It thus seemed that whilst firms were friendly to these village associations yet the time when they would be thoroughly wide spread, reliant and competent seemed so distant that the general feeling was that in the immediate future seed distribution through the help of Government officers ought to be pushed still more vigorously.

Item 4 on the agenda was then taken up; viz., to consider whether means were possible towards helping to grade produce more satisfactorily either by organising auction sales in markets; or by heavier deductions for bad or inferior quality or by firms making advances on crops grown pure to be inspected whilst on the ground. The system of the markets of Berar had at times been held up as worthy of imitation Messrs. Ralli's representatives kindly explained that system; the point was that there was there a proper open market in which the ryot had a better chance of knowing the correct price of the day and getting a fair price for the quality of the cotton he brought for sale, whereon other representatives present agreed that open and recognised markets would not materially assist in checking mixing or adulteration and that the lines of business in Madras were now so well established that it would be almost impossible and most probably inadvisable to attempt to interfere with them. On the second suggestion the firms agreed that they had it entirely in their own hands. They undoubtedly did penalise bad samples. They were not prepared to consider any system of advance against growing crops known to be pure and inspected when on the ground as they were all of the opinion that it would probably cause more difficulties than benefits. In reply to a question Mr. Chadwick said that the Agricultural Department did not attempt to handle ryots' cotton directly on its way to the firms in order to examine the quality and that they could not undertake to do so. The extent to which they had gone in the past was to give to a few of the villages with whom they

had been working satisfactorily from four to six years an introductory letter to a firm—to the effect that the cotton which these villagers were bringing was the produce of pure selected seed. This was one of the ways by which they tried to bring the firms into closer touch with those who were growing selected strains.

Under the fifth heading as to how the trade can be best kept in touch with the work of the department (*a*) in local areas and (*b*) more generally, all that materialised was that firms working in a particular locality would be glad before the picking season commences of information as to the villages which to the knowledge of the department had cultivated selected seed that season. From time to time the work which had been done on cotton should be collected and summarised in a more convenient form than it now appears in the annual official reports.

The question of the manner in which cotton could deteriorate in value after leaving the grower provoked some discussions. It was emphasised once more that wilful watering is not common in this Presidency and that mixing of cotton waste is probably less prevalent than previously; mainly because mills are taking action to do all they could do to prevent it. Mr. Wathen of the Madras Railway showed from his returns that the quantity of waste booked as such on the railways was inconsiderable. Mixing however was common and this was the chief difficulty with which spinners have to contend. Mr. Vital Das Sait explained that it was often done even in the early stages since when complying with forward contracts ryots would, in order to endeavour to save themselves from loss when prices fall, often endeavour to mix good and inferior types together. Government officers could not deal with this. But whilst on this subject of mixing, Mr. Chadwick mentioned a danger which was threatening Tinnevelly cotton. All dealers in that tract knew of it and he wondered whether anything could be done to avert it. Thus was the cultivation in North Tinnevelly of a low grade of cotton known as pulichai or mailam or jari. It was really a low grade form of Bengals introduced from the United Provinces. Mr. Chadwick read an extract from a letter from a village association in which the members said that they almost *despaired* of ever being able to eradicate it, unless all interests, including all firms could agree to combine to fight it. It was readily agreed that Tinnevellies maintained their price in the world's markets on account of their special quality; and if the cultivation of this Bengal cotton, became so general as to be the prominent type in that tract of

country prices would necessarily fall to that which is obtained for Bengals, one of the lowest priced cottons of India. The attraction from the point of view of the ryot is that this poor cotton yields more heavily than karunganni or Tinnevelly cotton and so if some of it can be passed off mixed with the Tinnevellies it is naturally immediately profitable, although the ultimate effect of such action may be disastrous. It was only introduced some seven or eight years ago; and very shortly after its presence had been detected the local firms endeavoured to combine together to stamp it out by refusing to purchase bales of cotton containing it. This agreement however broke down. But since at last a selected strain of karunganni has been obtained suited to this northern tract of Tinnevelly and capable of ginning at 33 per cent., *i.e.*, as much as this pulichi or mailam; there is now a substitute ready to be put before the ryots and an attempt was made at the meeting to sound the exporting firms as to whether they would in these circumstances be prepared once more to take conjoined action against this Bengal intruder. It was, however, not possible to come to any working conclusion as Messrs. Ralli's representative present was unable to make any engagement binding on their firm without reference to head-quarters. The question is one of of considerable difficulty and is of great importance to north Tinnevelly.

Messrs. Alexander and Lennon of the Buckingham Mills introduced the question of the damage done to lint in small ginning factories which existed chiefly in the northern portion of the Presidency and in Coimbatore. Mr. Vital Das Sait and Mr. Winter of the Coimbatore Mills also agreed. Mr. Wait speaking from experience of the Bellary district stated that where ryots had to bring their cotton a long lead to a large buyer these small ginning factories were undoubtedly of advantage in saving carriage. But there was no doubt that these small ginneries were often very badly run. No stock of spare parts was kept; the leathers of the rollers were not renewed which is absolutely necessary, and very great damage to the lint, even up to 20 per cent. in value, would result from this bad handling. It was strongly urged that all such gins should be inspected by a Government officers who must have had experience in the practical handling and management of cotton gins. The difficulty as Rev. Bawden at once said was to determine how the orders given at such an inspection could be enforced. It would entail legislation and the inspection of all ginneries large and small. Whilst such an act would be admittedly

difficult to enforce and on general ground probably undesirable; yet the firms emphasized the damage that was thus being done to the cotton crop simply by bad ginning. The Departments of Industries and Agriculture said they would endeavour to see what they could do to mitigate this evil. It was stated that in Coimbatore well ginned cotton would sell for Rs. 4 or 5 over badly ginned cotton. Many of the gins in this district had been erected in conjunction with Pumping installations and consequently could be inspected at the same time as the pumps and engines.

On the matter of statistics Mr. Chadwick explained those that were issued and stated that he was aware that frequently the forecasts differed widely from the actuals. The last year or two had seen an improvement and all he wished now to say was that he welcomed any criticism on them at any time. More accurate figures of area were now being obtained but the difficulties came in estimating the outturn of the crop. This difficulty was somewhat greater in this Presidency than in other parts of India as in order to suit the general conditions of all India forecasts had to be brought out at a time when was somewhat early to estimate the crop in Madras. This is especially the case with Tinnevelly cotton which is the latest sown in India. The firms agreed that these returns were useful. They wanted them as accurate as possible, and that they would not tolerate any margin or error. Mr. Cross of the South Indian Railway here interposed that for the purposes of making the most economic use of waggons, the railway also required to know in advance as accurately as possible the stocks of crops of produce which would likely be moved and whilst he had his own inspectors out making enquiries yet the reports prepared in the Director's office are exceedingly useful to him for purposes of check. This was especially the case in the larger and heavier crops and he was certain that there was more information available in that office which could be conveniently communicated to him than he was getting at present. A promise was made that this would be seen to. Mr. Chadwick then explained the new returns which it was proposed to be introduced by which every press and mill will send to his office every fortnight a statement of the number of bales pressed and of cotton received. This would be compiled in his office and would be totalled for the different tracts. These totals will be communicated to the papers and to such firms as required them as well as to the Director of Statistics, Calcutta. Every firm present welcomed this new move and wanted to know why it should not be done every week

instead of once a fortnight. Mr. Chadwick replied that he could and would get it done every week if the firms wished it. He had thought that the firms might find the supply weekly returns inconvenient. This view was generally scouted and it was stated that weekly returns especially if those of current exports could be added would be a great improvement. These were promised. On examination of the forms Mr. Cross asked that the cotton should not merely be described by its trade names but districts from which it comes should be shown at foot-note. What he wanted was if possible districtwar totals. The Coimbatore Mills and Mr. Vital Das Sait strongly urged that in all returns figures of Cambodia cotton should be given separately from the others. In reply it was stated that whilst on paper it seemed the simplest thing in the world to collect figures of areas sown yet in actual practice it was very difficult to drive into the heads of the local taluk and village officers that such compilations of figures early in the season served any useful purpose at all or were anything but an unmitigated nuisance; and that at present it was found sufficiently difficult to obtain approximately correct figures of totals without further complicating returns by requiring figures for different varieties of cotton sown in the same village. Mr. Vital Das Sait urged that sufficient indication would be given if village accountants were required to differentiate between irrigated and unirrigated cotton. It is possible that some such change could be feasible. The Tinnevelly Mills said they required no such distinctions in the forms but other mills especially those from Coimbatore maintained that such information would be useful.

On the question of Cambodia being raised there was a consensus of opinion that on the whole the Cambodia cotton which is now coming on the market is not as good as it was a few years ago. It was frequently badly mixed and in some cases had unduly deteriorated. It was admitted that very good samples were still obtainable and that much of the deterioration might very possibly be due to cultivation in unsuitable localities; but it was very strongly urged that work upon Cambodia similar to that already done in Tinnevelly and on Northerns was an urgent necessity. It was a cotton that possessed very great possibilities and all representatives from the Coimbatore district whatever their interests supported each other in maintaining that selection and district work upon Cambodia ought not to be any further delayed. Others said that till they came to the meeting they had not realised that so much work had been done at

Tinnevellies and Northerns and having seen and heard what had been done they felt the more strongly that Cambodia in their districts ought not to be neglected. It was stated that this was one of the earliest new works which the department intended to take up and there the matter dropped with the expression of the hope that the time when the department would be strong enough to undertake it would soon come. Rev. Bawden observed that the impression borne in upon him by the day's discussions all tended to show that better practical education and training was a real solution of the difficulties now experienced and he firmly believed that more rapid results could be obtained by endeavouring to get hold of the younger generation instead of trying to work with the elders. But he readily conceded that the difficulty was how to put such a theory in practice at the present time and although he had given constant consideration to this problem he was not able to suggest any means of solving it.

II.—GROUNDNUT.

COMMITTEE ON GROUNDNUT.

DECEMBER 14TH, 1914—3 TO 4-30 P.M.

Present :

The Hon'ble Mr. Ll. E. Buckley, I.C.S., *Chairman.*

1. Mr. J. Christie, Messrs. Peirce, Leslie & Co., Calicut.
2. Mr. O. Steiner, Messrs. Volkart Brothers, Madras.
3. Mr. T. M. Ross, Messrs. Best & Co., Madras.
4. Mr. H. P. M. Rae, the Bombay Company, Madras.
5. Mr. W. R. H. Wait, the Bombay Company, Madras.
6. M. R. Ry. C. K. N. Sundaresa Ayyar Avargal, Messrs. C. K. Narayana Ayyar & Sons, Madras.
7. Mr. W. K. M. Langley, Messrs. Peirce, Leslie & Co., Calicut.
8. Mr. F. G. Warbrook, Messrs. Massey & Co., Madras.
9. M.R.Ry. C. Arunachala Mudaliyar Avargal, the Zamindar of Chunampet, Chingleput.
10. M.R.Ry. Diwan Bahadur M. Adinarayanayya Garu, Madras.
11. M.R.Ry. Raja P. Ramakrishna Rayaningar, Zamindar of Vittalapuram.
12. M.R.Ry. Raja Panuganti Venkata Ranga Rayaningar, Zamindar of Kallur.
13. Rev. S. D. Bawden, American Baptist, Telugu Mission, Kavali, Nellore District.
14. M.R.Ry. P. Ramamurthi Chetti Garu, Vizianagram.
15. M.R.Ry. V C. Velliangiri Goundar Avargal, Coimbatore.
16. M.R.Ry. A. Vedachala Ayyar Avargal, Assistant Registrar, Co-operative Societies.
17. Mr. A. Chatterton, C.I.E., Director of Industries and Commerce, Mysore.
18. Mr. W. A. Cross, Traffic Manager, South Indian Railway.
19. Mr. Wathen, Traffic Manager, Madras and Southern Mahratta Railway.
20. Mr. D. T. Chadwick, Director of Agriculture.
21. Mr. R. C. Wood, Principal, Agricultural College, Coimbatore.

22. Mr. H. C. Sampson, Deputy Director of Agriculture, Southern Division.
23. Mr. G. R. Hilson, Deputy Director of Agriculture, Northern Division.
24. Mr. G. D. Mehta, Deputy Director of Agriculture, Central Division.
25. Mr. R. Thomas, Probationary Deputy Director of Agriculture.
26. Mr. W. H. Harrison, Government Agricultural Chemist.

AGENDA.

I. The reasons why Coromandel groundnut fetches the lowest price in the Marseilles market and the causes,

(*a*) indifferent cultivation,
(*b*) bad preparation,
(*c*) defective shipping,

with possible remedies.

II. By what means and to what extent can firms and the Agricultural Department co-operate in establishing better methods of decortication in the villages—

(*a*) by the introduction of better machines,
(*b*) by firms dealing more directly with village associations which own and work their own machines?

III. The difficulties which attend the export of oil and whether that could not be encouraged and the cake retained in the country to a greater extent.

IV. Statistics.—How they can be made more generally useful?

V. Any other suggestions or criticisms to improve either the quality or the methods of trade.

NOTE ON GROUNDNUT.

It is only within recent years that the groundnut crop has become of economic importance to Madras. A small area was reported to be under cultivation in the South Arcot district in 1850 and the extension of that area slowly increased to 20,000 acres in 1870. From South Arcot it spread to the adjoining districts and in 1882 the total area in the Presidency was 73,568 acres of which 48,000 were in South Arcot district. In 1890 the area had increased to 279,355 acres of which 185,876 acres were grown in South Arcot while the balance, except for 4,464 acres, were grown in districts immediately adjoining South Arcot. In 1891 the total export estimated as kernels from the Coromandel Coast was estimated to be over 2,000,000 cwt.

2. From this time onwards the area under this crop and consequently the exports, steadily declined, until the exports from Pondicherry which in 1891 were equivalent to 1,565,510 cwt. of kernels were in 1899 only equivalent to 94,925 cwt.

3. In about 1897 efforts were made both by Government action and private enterprise to introduce better varieties. The existing variety was known to give a low percentage of oil much lower than that of varieties grown in other parts of the world. The Pondicherry Chamber of Commerce introduced a variety from Senegal and also made trials with seed obtained from Bombay, while it is recorded that private enterprise introduced a variety from Mozambique. The Agricultural College at Saidapet also introduced varieties from East and West Africa, Mauritius, Japan and America.

4. Of these, the variety from Mozambique (now known as Mauritius) appears to have been the only one the cultivation of which ever extended; and by 1900 the original variety of groundnut had, in the South Arcot district, been entirely replaced by this. Dr. Barber in the end of 1899 when touring in the Cuddalore taluk wrote that "after careful enquiry extending over many thousands of acres I only succeeded in finding four small patches of the original groundnut." The new variety had many advantages over the old. It was much more resistant to disease, it matured its crop in five to five and a half months instead of seven, it yielded a nut which contained about 6 per cent. more oil and was a much heavier cropping variety. It was therefore in a much better position to compete with the West African produce on the European

markets. The success of the new variety was in the first few years of its introduction considerably enhanced owing to the fact that the lands where groundnut had formerly been grown had been allowed a rest from this crop. Every one grew this new variety regardless of rotation until the necessity of a rotation made itself felt by the appearance of disease and of insect pests and reported deterioration of quality; fears were again expressed by the commercial community of the possibility of another collapse of the trade such as occurred in 1898–99. As the new variety came into general cultivation, however, the disease which had formerly made such ravages on the indigenous variety disappeared while the new variety spread from South Arcot, first to the adjoining districts of Trichinopoly, Tanjore, North Arcot and Chingleput and subsequently to the whole of the Presidency, especially to the Ceded Districts, and to Coimbatore and Salem. The spread of groundnut cultivation can very well be seen from the statement attached Now instead of South Arcot growing 75 per cent. of the area under this crop little more than 25 per cent. of the crop is grown in this district.

5. Complaints are still received regarding deterioration stating that the groundnut is not so well filled as formerly and that the percentage of oil has decreased. This can very well be the case, but it is due in all probability to the fact that the crop instead of being confined to the districts of the Coromandel Coast has now spread throughout the Presidency and very extensive areas are now grown in districts where the rainfall is so light that the crop cannot, except in very favourable seasons mature properly. The result is the crop ripens prematurely before the kernels are well filled. Not only this but the recent rise in the price of oilseeds has led to a marked extension in the area under groundnuts even in districts considered favourable to this crop. In South Arcot for example where for ten years the area under groundnut remained practically stationary, an increase of 100,000 acres between 1911 and 1914, shows that either less regard is now had for rotations, or that land, which formerly was not considered suitable for this crop, is now cultivated with it The variety now grown has not in itself deteriorated and it is possible to grow just as good crops with as high a percentage of oil and with as well filled nuts as formerly.

6. The Government Agricultural Station in the South Arcot district which was started in 1905 mainly with the idea of studying groundnuts has tested many varieties obtained from all parts of the world. Although some of these

have in odd years shown a better yield than the local Mauritius, the latter on the average, still holds its own. One or two varieties have in the last two or three years shown higher yields but not sufficient to warrant their introduction.

7. In the case of groundnuts grown under irrigation analyses of "Mauritius" show that in 1913 the percentage of oil to kernel and the percentage of kernel to husk were 49·84 and 80·19 per cent. respectively: the average percentage for the same variety since 1907 being 47·38 and 79·23 respectively. When treated as a rainfed crop, the analysis in 1913 was similarly 50·49 and 80·15 against the average since 1907 of 47·38 and 79·83 respectively. In point of yield of oil per acre the "Mauritius" stands first of all varieties tested when grown as an irrigated crop, and except for recent introductions, fourth in the case of rainfed crops. Twenty separate analyses of this same variety made last year, grown as a rainfed crop either under different conditions or on different fields gave, on an average, 80·23 per cent. of kernel to husk and 50·3 per cent. of oil to kernel. Of twelve varieties analysed only one gave results approaching this.

8. A more serious matter, however, is one recently referred to in the Indian Trade Journal (July 1914, p. 27) which draws attention to the heated condition of the groundnut from the Coromandel Coast when it arrives at Marseilles, and which ascribed this condition to the fact that the kernels are damped before shelling and are not subsequently properly dried. The result is that where the nuts are trodden down in loading the vessel they very often heat, sometimes so badly as to become charred. Complaints are also received from Marseilles of the lower average oil content. The Madras product always fetches a lower price than that from West Africa.

9. Apart from the fact that groundnut is admittedly grown in many parts which are only suited to this crop in favourable seasons, there appear to be many points where improvement in the marketing would help to improve the quality. "Machine shelled" nuts for instance fetch prices considerably in advance of those paid for "hand shelled" nuts, the reason being that for hand shelling the nuts have to be previously damped otherwise the kernels are apt to break. Unless such shelled nuts are immediately and thoroughly dried the oil becomes rancid. Already considerable advance has been made by private enterprise in the installation of machine shellers and these are now to be found throughout the Southern districts. Since the process of shelling by the machinery breaks fewer nuts and since the nuts do not require

to be damped before shelling, it is likely that in all important groundnut tracts hand shelling will in time disappear. In South Arcot district the charges for hand shelling is about As. 2 a maund and the same rate is at present charged for machine shelling but the latter will probably be reduced when competition becomes keener. At present everything favours the machine shelled nuts. The producer gets a better price for his produce and the export merchant gets produce which is not so badly damaged and at the same time it is dry and much freer from stones and dirt.

10. On the question of shipping oil from India instead of the kernel the Director of Industries writes as follows :—

"I should like to draw the attention of the Conference to "the fact that sooner or later the manufacture of oil in India "is bound to take the place of the export of seed. When "this change will come about I do not care to prophesy. "This depends entirely on the methods which Indian manufac-"turers adopt; but I regard the change as inevitable."

11. Even now it is being exported in small quantities and when last on leave I made careful enquiries regarding the oil market at home. I there learnt that so far as the demand was concerned there was little difficulty to be apprehended; but the universal complaint regarding Indian oil was the tendency towards adulteration. Seed represents a commodity which does not lend itself to adulteration and the value of which is therefore fairly well fixed. In the case of oil the value depends almost entirely on its purity. Speaking broadly, it may be asserted that oil that has been heavily adulterated has no market value at all, *i.e.*, does not command a sale. I am afraid the tendency towards adulteration already mentioned is likely to spread rather than decrease as the oil industry develops; and if this industry is to prove of any practical benefit to the country it seems to me that some method of control must perforce be introduced. It has been suggested to me by large exporting firms that the trouble might be saved if in this country fair samples of the oil were drawn before despatch and analysed; and I would suggest to the Conference the desirability of introducing into India some sort of official testing.

12. I anticipated that a test bureau of this kind would be of value not only to the oil industry in connection with which I suggest it, but certain numerous other industries also; indeed in my opinion Indian Industry—so far as the export market is concerned—will not go very far unless "Hall marked," so to speak, by an official Government department.

Distribution of the acreage under groundnut.

Year.	Presidency.	South Arcot.	Chittoor, North Arcot, Chingleput, Trichinopoly, and Tanjore.	Ceded Districts.	Salem and Coimbatore.
	ACS.	ACS.	ACS.	ACS.	ACS.
1850 ..	4,000	4,000	...	...	...
1870 ...	20,000	20,000	...	...	...
1882 .	74,000	48,000	...	...	...
1888-96 ...	225,000	145,000	...	...	...
1896-97 ...	157,000	88,000	...		...
1897-98 ...	94,000	52,000	...	...	
1898-99 ...	116,000	71,000	...	...	...
1899-00 ...	174,000	133,000	...	...	..
1900-01 ...	276,000	208,000	...	...	...
1901-02 ...	417,000	301,000	110,000	...	...
1902-03 ...	497,000	343,000	143,000	...	...
1903-04 ...	480,000	302,000	160,000	...	..
1904-05 ...	436,000	281,000	131,000	3,000	8,000
1905-06 ...	502,000	326,000	144,000	4,000	10,000
1906-07 ...	646,000	377,000	208,000	15,000	20,000
1907-08 ..	838,000	367,000	277,000	72,000	64,000
1908-09 ...	931,000	397,000	318,000	38,000	108,000
1909-10 ..	896,000	375,000	301,000	69,000	89,000
1910-11 ...	934,000	376,000	341,000	70,000	78,000
1911-12 ..	1,299,000	432,000	452,000	150,000	159,000
1912-13 ..	1,466,000	435,000	462,000	231,000	120,000
1913-14 ...	1,605,000	463,000	494,000	361,000	160,000

Export value.

——	Madras.	Pondichery.	Total.	Extended approximate quantity in maunds of kernel.
	RS	RS.	RS.	
1899	8,00,000	3,00,000	11,00,000	275,000
1900	14,00,000	20,00,000	34,00,000	680,000
1901	71,00,000	46,00,000	1,17,00,000	2,463,000
1902	68,00,000	92,00,000	1,60,00,000	3,048,000
1903	1,08,00,000	73,00,000	1,81,00,000	4,260,000
1904	90,00,000	50,00,000	14,00,000	4,000,000
1905	69,00,000	39,00,000	1,08,00,000	2,880,000
1906	99,00,000	50,00,000	1,49,00,000	3,137,000
1907	97,00,000	67,00,000	1,64,00,000	2,982,000
1908	1,16,00,000	67,00,000	1,83,00,000	3,050,000
1909	2,05,00,000	1,04,00,000	3,09,00,000	5,150,000
1910	2,13,00,000	1,18,00,000	3,31,00,000	6,018,000
1911	2,35,00,000	1,37,00,000	3,72,00,000	5,723,000
1912	2,95,00,000	1,28,00,000	4,23,00,000	7,356 000
1913	3,48,00,000	1,55,00,000	5,03,00,000	8,380,000

Statistics.—Apart from the Customs and Railway returns, etc., the only statistics published by the department are forecasts of sowings on October 15 of each year and of outturns on February 10.

SUMMARY OF THE DISCUSSION ON GROUNDNUT.

In opening discussion on the reasons for which Coromandel groundnut does not command a higher price in the European market, Mr. Chadwick said that complaints have latterly been received of a slow but steady deterioration in the oil content of the nut. Detailed figures from Marseilles have not been received prior to 1909. But in that year the percentage of oil to kernel was 43 per cent. and has since declined steadily to 41 per cent. One reason is undoubtedly indifferent cultivation ; the recent rise in prices has so stimulated the spread of this crop that it is now cultivated on land not specially suited for it and in some cases in defiance of old rotations. Attempts are being made to deal with this which is purely an agricultural problem. Indications are fairly general that more attention is again being paid to rotations. Mr. Chatterton enquired whether there were any experimental data on record as to the quantity of oil from nuts raised in different kinds of soil because he was inclined to think that there was a tendency to cultivate groundnut in places in which the oil yield must necessarily be so low as to make the cultivation of the crop unprofitable. This conclusion was not accepted because all evidence available showed that under the prices prevailing before the war groundnut cultivation had very rarely resulted in any actual loss to the cultivator however poor had been his land. But there was no doubt that in certain tracts, as for instance the Circars, the ryots for climatic reasons were compelled to lift their crop before the nuts were fully matured. It frequently happens in those parts that rain does not continue late in the season and consequently unless the crop is harvested in good time the ground becomes so hard as to make the cost of lifting excessive. This early lifting must necessarily react upon the oil content of the kernel. Another defect to which attention has been drawn in the "Indian Trade Journal" was that deterioration sometimes occurred owing to defective shipping arrangements. When full cargoes are shipped in vessels having no tween-decks the super-incumbent weight of the kernel causes the lower portion to heat and if they are at all damp to turn black and rancid. It was difficult to change the type of ship but the representatives of the shipping firms said that this evil can be avoided very largely by means of ventilating shafts which were frequently put in especially when dealing with machine-shelled kernels. It was barely worth while to do so when the kernels which were being shipped had been damped or were at all damp as a certain amount of rancidity was then

almost inevitable. Thus apart from the purely agricultural side of the question it appeared that the one chief cause round which complaint centred was chiefly due to bad handling after lifting. Although Anantapur and the surrounding districts were not so well known as South Arcot for their groundnut yet the crop was received in a very much better conditions from the former districts. The custom of wetting the shell in order to facilitate its removal by beating was probably more prevalent in South Arcot than in any other district. Every one present who had to handle the groundnut crop in any way in the course of business agreed that this custom of damping was the chief defect. A letter from the Pondicherry Chamber of Commerce was read giving the average prices paid for machine-shelled kernels and for those shelled by damping. These figures showed that machine-shelled kernels always commanded about Rs. 5–6, a candy better price than hand-shelled kernels the nuts of which have been damped, and that at the period in which prices ruled lowest the difference in price was still greater. In other words when the crop comes heavily on the market the price of hand-shelled kernel falls more rapidly than that of machine-shelled. This at once provoked a discussion on the merits of the various machines devised for shelling nuts. The officers of the Co-operative Department were very much interested in this as if a good and fairly cheap machine could be obtained to do this work there would very probably arise a large demand for it from village associations but hitherto they had not felt themselves competent to recommend any particular machine. The one most commonly used is that known as the Sangli machine from Bombay Presidency or some modification of it. It is sold by Messrs. Marshall & Co., Madras. Its initial cost is about Rs. 250 and it requires a 5 h.p. engine to run it and although the quantity dealt with per day is considerable yet some 10 to 12 per cent. of the kernels become broken in the process of shelling. This figure was given by Messrs. C. K. Narayana Ayyar & Sons on their experience of work at Valavanur and was generally accepted by the meeting as approximately correct. A high figure of broken kernel is an actual defect as rancidity frequently spreads from these broken parts during the time of transport to Europe. The ideal required is a cheap machine which will work rapidly and yet not break the small brown cover of the kernel. Messrs. Best & Co. stated that they had been working on this problem for some time and believed that they now had a machine which would satisfy these conditions. It would

probably cost between Rs. 300 and 400, but on the other hand could be run by a portable oil-engine of much lower power, possibly only 2¼ h.p., and the percentage of broken seed was exceedingly small. An inspection of this machine in actual work was arranged for the following Thursday. Mr. Peryia Ramamurti of Vizagapatam asked for information as to the actual working results of the machine. Messrs. Best & Co. were not in a position to give actual figures as they had not yet determined the output of the machine over a long period, but they promised to supply the information. The general opinion was that there is a large opening for some such machine and representatives of firms present undertook to keep the Industrial, Agriculture and Co-operative Departments informed as to the results of their trials and particulars of their various machine. The Hon'ble Mr. Buckley said that it might be possible to get loans from the Government for the erection of such machines.

From this point discussion turned once more to the percentage of oil which could be extracted from the nut. On the carefully cultivated crops on the farms at Palur between 42 and 43 per cent. of oil was being regularly extracted from the local Mauritius nuts. This was not the result of any excessive manuring but merely followed from a careful attention to rotation and general cultivation. Messrs. C. K. Narayana Ayyar & Sons supported the statement generally by saying that from the better cultivated crops of the ryots they were able to extract at Valavanur from 38 to 39 per cent. Mr. Chatterton was at first inclined to doubt these figures as the results obtained from his Anderson's Extractor did not approximately agree therewith. But on his explaining the methods in which this extractor worked it was clear that the percentage he referred to was the percentage of oil to whole nuts and not of oil to kernel. Even then there was discrepancy of about 3 per cent., but this was possibly due to inferior samples of nut. He further explained that the Anderson's extractor can only be worked satisfactorily when whole nuts are fed into the machine and not the kernels. There is one now running on trial at the office of the Department of Industries. Samples of the oil so obtained were shown. All colouring matter could be removed by filtering through Fuller's earth. The resultant cake comes out in thin sheets which can be very easily broken up and so made useful for cattle food or manure. With the hydraulic presses for extracting oil, the cake is much harder and requires to be broken to a fine powder by machinery; or very thoroughly

pounded before it becomes readily available for manuring purposes. Mr. Langley and Mr. Harrison stated that cake so made would contain from 1 to 1¼ per cent. less nitrogen than that obtained from Hydraulic press, and a little more oil would be left in it. Both these facts lessen slightly its value as a manure, but even then it would be very valuable for this purpose. It would also form a good feeding stuff for cattle. This led to a discussion as to the openings for the use of cakes in this country. The officers of the Agricultural Department strongly maintained that the use of poonacs as fertilisers for sugarcane and in many places for wet land was spreading and it seemed likely to spread more and more. This was the case in South Arcot and Tanjore where it is already widely in use. From the general economical point of view an extended use of concentrated manures on wet lands and garden lands would be beneficial as it would lessen the call upon cattle manure and liberate its use for other land. Mr. Cross of the South Indian Railway showed that from their traffic returns that four-fifths of the groundnut cake booked was entered as for manurial purposes which the officers of the Agricultural Department thought very fairly represented the proportion in which this cake was used for manure and fodder. Mr. Ross of Messrs. Best & Co., however, pointed out that it could not be concluded if oil pressing was largely extended that a local market would immediately be found for the cake as at present after satisfying local needs a large balance still remained over for export.

The question of freights coming up Mr. Cross showed that the South Indian Railway already gave minimum rates for all such manures and in answer to his direct question Mr. Chadwick readily agreed that the South Indian Railway had always met the Department's requests for special freights very readily and generously. Things moved more slowly in the northern half of the Presidency but when the need arises the department fully expects to get similar consideration from the Madras and Southern Mahratta Railway. Mr. Cross promised to supply the Agricultural and Co-operative Departments with figures showing from what districts cake was now most largely exported and whither it went, as this would facilitate the work of both departments whether in expanding the further use of this cake as a manure or in arranging for its co-operative purchase by those who are using or have just taken it up.

The discussion then spread to the possibility of extracting oil on a greater scale in the Presidency and exporting the oil instead of the kernel. Local extraction of oil on a

commercial scale is not impossible but the difficulties before it are greater than many imagine. Marseilles has already an established position in the world's markets for the different classes of oil in which they are protected by about 26 per cent. duty. Oils lend themselves very readily to adulteration and it would require a long period of good work for Indian mills to obtain a reputation which Marseilles factories now possess and which form such a valuable asset in international trade. It is not as if groundnut oil were used for only one purpose so that the subsidiary industry dependent upon it could also be started at the same time. Further it became clear that in order to turn out a groundnut oil similar in quality to those already manufactured the brown tegument which covers the kernel must be removed for which special plant is required. If this be not done it becomes exceedingly difficult to remove the flavour which ordinary groundnut oil possesses.

On the question of statistics the representatives of firms and others said that they had no suggestions to make for, as far as the export trade is concerned they have found the forecast of the last few years form a very fairly accurate indication of the crop to be exported. Attention then turned as to what steps were feasible in the present difficulties caused by the dislocation of trade due to war but nothing materialised. The tendency for the present appears to be for the ryots to hold up their crop the wisdom of which in view of the risks which always attend storage seemed very doubtful. If storage be decided upon, undoubtedly the best way of doing it is not to shell the nuts but to store them unhusked, but even then considerable loss is likely to occur from the ravages of insects. The prices which are being offered at present in the market are not very much less than those that prevailed some six or seven years ago and if accepted would leave a profit to the cultivator although nothing like that which he has obtained during the last two or three years. Marseilles the chief market in the past for groundnut was not yet making any serious enquiries after this year's crops. Mr. Chatterton enquired whether by dessicating the nuts they could not be stored indefinitely, but no one had any exact information on this point and those who dealt in groundnut doubted very much whether this would overcome the difficulty. Moreover it appeared that there was already a limited market for groundnuts at prices which left a profit to the cultivator but the tendency seemed to be for him to hold out for better terms. This last was a very doubtful policy as it would only delay the opening of trade and might depress prices still more later on when more ryots would be compelled to sell.

Mr. Cross informed the Conference that proposals had been to appoint a commission in Pondicherry to enquire into the deterioration of the nut. It seems however that on account of war this commission had never sat, but Mr. Chadwick thanked him for the information and said the department would certainly endeavour to keep in touch with that commission if and when it arrived. Mr. Sundaresa Ayyar of Messrs. Narayana Ayyar & Sons said he would like, if possible to get information about the varieties and methods of cultivation of groundnut in Mozambique, Senegambia and West Africa in a form similar to that in which the bulletins of the Agricultural Department of Madras are issued.

III.—WOOL.

COMMITTEE ON WOOL.

DECEMBER 14, 1914—4-30 TO 5 P.M.

Present:

The Hon'ble Ll. E. BUCKLEY, I.C.S., *Chairman.*

1. Mr. J. W. Chambers, Bangalore Woollen Mills.
2. Mr. A. Chatterton, C.I.E., Director of Industries, Commerce, Mysore.
3. Mr. D. T. Chadwick, Director of Agriculture.
4. Mr. G. R. Hilson, Deputy Director of Agriculture, North Division.
5. Mr. R. Thomas, Probationary Deputy Director of Agriculture.

AGENDA.

I. Criticisms and suggestions on the present method of work.

II. The qualities required in Indian wool, *e.g.*, texture, colour, length of staple, twist and the defects in the present supply.

III. Is the remedy to be sought in selection within India or in crossing with imported blood.

IV. Can the department assist consumers in any way in obtaining better grades of wool and informing producers where to market their wool.

V. Any other suggestions or criticisms.

NOTE ON WOOL.

Work on the improvement of the sheep of the Presidency both from the point of view of wool and mutton production appears to have been first begun at Saidapet some time before 1868. The breed of sheep kept was named the Saidapet

breed but was originally a mixture of the Patna, Nellore, Mysore and Coimbatore breeds, later half bred South-down-Mysore rams were used with the flock. The system under which breeding was done was to weed out the poorest specimens and to use only the best rams bred for stud purposes.

The progress made in the improvement of the wool may be judged from the following extracts from the Saidapet Farm records compiled by Mr. Benson :—

" *Wool Production.*—When sheep breeding was com-
" menced, the wool yielded by most of the sheep was exceed-
" ingly coarse and almost straight. It is now much finer
" and more a true wool. There is, of course, very much yet
" to be done before the average quality of the wool will be
" good, but the improvement that has been effected is very
" encouraging.

" In 1872 the following valuation of the wool of this
" breed was made by " a professional London wool-broker.'

" The two samples of wool sent to us for valuation are
" ' fair East Indian yellows,' worth here from 11*d.* to 11½*d.* per pound.

" In comparison with the value of wool produced in the
" colonies this wool is certainly not a valuable kind, still the
" difference in value is not so great as might have been
" expected. Thus, when this wool was valued, the following
" rates were quoted in the London wool market report :—

	s.	*d.*
Queensland and New South Wales, ordinary per lb.	1	2
Victoria, ordinary per lb.	1	3
Tasmania do.	1	3
New Zealand do.	1	2

" The best colonial wool in unbroken fleeces was then
" selling at from 2*s.* 4*d.* to 3*s.* per pound. The rates quoted
" above or for wools classed " broken pieces and locks," to
" which class the wool submitted for valuation belonged."

As regards the average clip per sheep there are not sufficient data to say what progress was made in increasing this, but in 1884 the figure stood at 1½ lb. though individuals in the flock gave two and three pounds.

With the closing of this farm the flock was dispersed.

A fresh start has again been made and a flock of the local Bellary sheep is being worked up at Hagari. White-woolled animals were purchased and only white-woolled rams are being used, but black lambs occur frequently. What is being aimed at first is the establishment of a pure hardy

white-woolled breed, which shall give as heavy a clip of as fine a wool as possible.

The method adopted to gain this end runs on very much the same lines as the system adhered to at Saidapet, but in addition some close in-breeding is being done with a view to finding out something about colour inheritance with this very mixed breed of sheep.

Too short a time has elapsed for any great progress to have been made, but the results so far obtained show that, given fair grazing, these sheep are capable of giving better clips than the local average of 1 lb. per sheep, and from the variation in type and quality of fleece that there is distinct hope, with care in breeding, of producing a finer class of wool.

SUMMARY OF THE DISCUSSIONS ON WOOL.

Mr. Chambers of the Bangalore Woollen Mills said that the wool which came from Kolar and the portion of Mysore north of this was best suited for their purposes. It was undoubtedly better than that from Bellary and Anantapur and surmised that possibly the climate had something to do with it. The Kolar wool was cleaner, freer from kemps and hair and was of a superior texture. A very fine wool was not required in Southern India but it was very necessary that the clip should come off in the nature of a fleece and not in separate locks as at present. With fleeces as in England and Australia it was possible to separate the different portions, all of which provided wool for different purposes, but with bundles of detached locks no such separation was possible. The Kolar wool was brown black in colour and although highest prices were undoubtedly commanded by pure jet black wool yet this was only for a special purpose, viz., ornamental borders. On the whole it would be an advantage to get a much larger supply of white wool.

The main immediate problem was however the total supply of wool. For instance at the present their mills alone required about three million pounds of wool a year whilst he estimated the total South Indian production at only two and a half millon pounds. Mr. Chatterton strongly bore him out in this. Compared with the weight of fleece per sheep in other parts of the world on average yield of 1 lb. per sheep as was the case in Southern India was almost ridiculous. The records show that in Australia by attention to breeding and feeding

the average yield of wool per head of flock had been increased to 6½ lb. and latterly up to 7¼ lb. per head. In ten years between 1891 and 1901 the number of sheep in Australia had decreased by 9,000,000 and yet the total yield of wool had been increased by 240,000,000 lb. It was not contended that Madras would get yields per sheep similar to those in Australia but as the local yield is now only 1 lb. per sheep the possibilities of improvement seemed immense. It was surmised that this was not only a matter of breeding but of feeding and Mr. Hilson stated that in the very few years in which he had been at work on sheep at Hagari the average clip from the younger generations is 2 lb. although that from the sheep with which he started work averaged less than 1 lb. In reply to a question whether this was not due to much better feeding he said that to a great extent that was undoubtedly the case but the improved feeding only consisted in regulating the use of his grazing grounds. His sheep were reared on the sandy banks of the Hagari river which Mr. Chatterton remembered as an absolutely bare and destitute stretch of river sand. This had been divided up into fairly large fields by thorn hedges, some thorn trees had been planted and the growth of grass encouraged by not allowing the flock on the land too soon. In the districts the fresh young grass rarely gets a chance as it is grazed over before it attains any growth. In view of these figures the possibilities of results seemed to be considerable but it would require great organisation and work as wool was about the most degraded of all Indian trades and the Indian shepherd formed very indifferent material on which to work. Mr. Chambers believed that selection from indigenous flocks formed the correct lines of work and this was the method followed at Hagari. At a later date merino crosses might be introduced. But the first requirement was a white-woolled sheep carrying a much heavier fleece very similar in quality to the wool now obtainable at Kolar—a little finer might be an advantage but great fineness was not required. At the same time quantity was the first essential. A small supply of better quality was of no practical use to the mills or for export. Taking as a unit the sets of machinery which were used in woollen mills a regular monthly supply of from 20,000 to 30,000 lb. of wool was required before it would pay to set up special machinery to make finer counts. Hence the first practical object to be kept in view was to try and get a white wool fairly similar in quality to the wool now obtainable in Kolar but which could be taken off the sheep in a fleece and would give very much heavier yields per head.

The shortage and inferiority of the local supplies of wool was also emphasized by the fact that both Mr. Chambers and Mr. Chatterton agreed that wool afforded many more openings for cottage industries than did cotton if the supply were there; and the latter officer also added that very small worsted manufactories worked by water power still persisted in Wales. Mr. Thomas however thought that in very recent years these had been dying out in Wales through the competition of the larger factories.

There was also a promising opening for a local worsted spinning mill but for this a finer stapled wool was required which at present would have to be imported. There was a very large import of German-made shawls into India.

It was suggested that Madras was far too hot for merino sheep but Mr. Chadwick pointed out that of the total amount of wool exported from the different States of Australia the proportion of merino wool steadily increased from south to north, and in view of this he did not consider it impossible to obtain a healthy breed in India containing merino blood at least by crossing merino with local sheep. But it was a waste of time to do so until a true white flock had been established in Madras. For worsteds certainly white wool was required. When that time come it would probably be well to endeavour to maintain locally at least one pure merino flock as a source of supply for pure bred rams. There was already a certain amount of merino blood in some of the flocks in South Mysore but the sheep were by no means true to colour.

The exceedingly bad manner in which the wool now comes to market owing to bad clipping or no clipping at all was also mentioned.

With Mr. Chambers once more emphasizing the large market there was for a white wool (coarse if judged by European standards) in big quantities the meeting came to a close.

IV.—MANURES.

COMMITTEE ON MANURES.

DECEMBER 15TH, 1914—11 A.M. TO 2 P.M.

Present :

The Hon'ble Mr. Ll. E. BUCKLEY, I.C.S., *Chairman.*

1. Mr. J. Barnard, Messrs. Parry & Co., Madras.
2. Mr. J. Armstrong, Messrs. Parry & Co., Madras.
3. Mr. A. A. Buchanan, Messrs. Parry & Co., Madras.
4. Mr. J. Christie, Messrs. Peirce, Leslie & Co., Calicut.
5. Mr. W. K. M. Langley, Messrs. Peirce, Leslie & Co., Calicut.
6. Mr. J. Wilson, Messrs. Binny & Co., Madras.
7. Mr. R. Stanes, Messrs. Stanes & Co., Coimbatore.
8. M.R.Ry. Gangarazu Pantulu Garu, Ganjām district.
9. R. D. Anstead, Esq., Government Planting Expert, Bangalore.
10. M.R.Ry. C. Seshagiri Rao Garu, Kottapalli, Gōdāvari district.
11. M.R.Ry. G. Jogi Razu Garu, Messrs. Tawker & Sons, Madras.
12. M.R.Ry. C. Arunachala Mudaliyar Avargal, Zamindar of Chunampet, Chingleput district.
13. M.R.Ry. C. A. Venkatakrishna Ayyar Avargal, Coimbatore.
14. M.R.Ry. Diwan Bahadur M. Adinarayana Ayya Garu, Madras.
15. M.R.Ry. N. Pattabirama Rao Garu, Madras.
16. M.R.Ry. P. Subbaraya Ayyar Avargal, Periakottai, Madura.
17. Rev. S. D. Bawden, American Baptist Telugu Mission, Kavali, Nellore district.
18. M.R.Ry. V. C. Velliangiri Goundar Avargal, Coimbatore.
19. M.R.Ry. K. Adinarayana Reddi Garu, Vellore district.
20. M.R.Ry. Raja P. Ramakrishna Rayaningar, Zamindar of Vittalapuram.

21. M.R.Ry. Raja Panuganti Venkataranga Rayaningar, Zamindar of Kallur.
22. Mr. A. Chatterton, C.I.E., Director of Industries and Commerce, Mysore.
23. Mr. D. T. Chadwick, Director of Agriculture.
24. Mr. R. C. Wood, Principal, Agricultural College, Coimbatore.
25. Mr. W. H. Harrison, Government Agricultural Chemist, Coimbatore.
26. Mr. H. C. Sampson, Deputy Director of Agriculture, Southern Division.
27. Mr. G. R. Hilson, Deputy Director of Agriculture, Northern Division.
28. Mr. G. D. Mehta, Deputy Director of Agriculture, Central Division.
29. Mr. R. Thomas, Probationary Deputy Director of Agriculture.

AGENDA.

I. What steps can be suggested for the greater utilisation of indigenous manures within the country, *e.g.*—

(*a*) Favourable freights on the railways.

(*b*) The establishment of pioneer depots in tracts wherein such manures should prove useful.

II. How could relations between manure merchants—whether dealing in indigenous or concentrated fertilizers—and the agricultural department be improved, and is any such scheme of joint action in furthering the use of such manures desirable or possible, *e.g.*—

(*a*) by exchange of experience,

(*b*) by the establishment of manure depots at suitable farms and credit sales through departmental agency.

III. Is any action desirable to prevent the adulteration of concentrated fertilizers, and if so, what standards of purity should be prescribed?

IV. Should manure mixtures be sold subject to a statement of ingredients?

V. How can the experience of the department be made more accessible to or of use to the trades?

VI. Whether and how assistance could be given for the trial on ryots' land of special fertilizers suited for special crops, *e.g.*, for tobacco or coconuts, etc.

VII. Any other suggestions or criticisms.

NOTE ON MANURES.

The importance of the question of the internal manure supply seems hardly to have been *fully* realised up to the present by those interested in both the internal and external trade in this commodity. The export of manures whether raw or manufactured means a very serious loss to the country, as it limits crop production and thereby limits not only the export trade in agricultural produce but also limits the purchasing power of the country.

2. The question of low rates for manures, etc., which indirectly lead to increased traffic earnings was last year discussed at the Freight's conference of the Railway Board and this body realised this to such an extent that railways were allowed to make their own rates for such commodities. Another point is that it makes little difference on the whole as to what crops utilise concentrated manures as the use of such manures for any crop liberates an equivalent amount of the existing supplies of bulky manures for other crops. An example of this is very well furnished by the South Arcot district. Here paddy is now (since the decadence of the indigo industry which supplied large quantities of refuse as manure) almost invariably manured with poonac, thus liberating the village manure supply for manuring the groundnut crop. The merchant, therefore, by fostering internal trade in concentrated manures instead of export, would not only assist in increasing the purchasing power of the paddy tracts but would at the same time assist in increasing the export trade in groundnuts.

3. This indicates the importance of this subject and the necessity for investigating and fostering the internal manure trade.

The subject is therefore discussed under the following heads :—

(1) The agriculture of the Presidency and how this is affected by, and affects the supply of manure.

(2) The system under which agriculture is carried on and how this affects the manure supply.

(3) The attitude of the farmer towards the use of concentrated manures.

(4) The indigenous resources of the country in supplying concentrated manures.

(5) The existing trade conditions of supplying concentrated manures.

(6) The class of manures for which there is a demand or for which a demand is likely to arise.

4. *I. The agriculture of the Presidency and how this is affected by, and affects the manure supply.*—This can be divided into three classes of farming—

(1) dry land farming without irrigation,
(2) dry land farming with irrigation, and
(3) wet land farming.

The first makes little if any direct demand on the supply of concentrated manures except in districts which have a certain regular and favourable rainfall. For dry lands, however, the maintenance of the mechanical texture of the land is of the greatest importance as this not only facilitates the conservation of moisture but it enables the soil during the long dry fallows to recuperate its fertility and thus to give the young crop that start in life which is so essential for crop production. On such land a manure must be both cheap and lasting and the indigenous bulky manures of this country are best suited for this purpose. It is such lands which produce two of our most important export crops, viz., cotton and groundnut, and it is essential for the prosperity of the country that the fertility of these should not be allowed to decline.

5. The second, viz., dry land cultivation with irrigation, includes all land under well irrigation as well as the rich alluvial lands which are unsuited for the paddy cultivation. It is here where the demand for manure is most keenly felt and at present crop production is very strictly limited and industry is greatly impaired by the lack of an adequate manure supply. It is also this class of farming which causes the shortage of manure for dry land. Such farming, involving as it does a considerable outlay of both recurring and non-recurring expenditure on wells and appliances or power for lifting water, demands all the ryot's industry and all his available manure supply to make his cultivation pay. In fact we may say that manure is the governing factor of this class of farming and that the supply of manure limits very strictly crop production. Thus where successive cropping is possible, long fallows are in some places introduced into the rotation and in others a catch crop is grown in the rainy season of some unimportant rainfed crop. The decrease in the area under Cambodia cotton is ascribed by some as due to this shortage of manure. Farmers, especially in the south, are abandoning Cambodia cotton in place of indigenous cotton as they say that the former with its shallow root system makes such heavy demands on the surface fertility of the land that they

cannot, with their limited resources for manuring, afford to grow it.

6. Herein lies a very large and expanding scope for the introduction of concentrated manures. This will however be mainly useful as supplementing and not altogether supplanting organic manures as the latter are of the greatest value in helping to maintain the mechanical texture of the soil. It is this class of farming which produces the highest acre value of crops in the Presidency and when the value of these and the increased outturn which can be obtained by the use of concentrated manures is considered, it is very difficult to see how European countries with their much smaller acre value of crops and their much greater cost of production can compete with India in the market for concentrated manures.

7. *Wet land.*—It is for wet land cultivation, which is mainly paddy, that there is the greatest immediate future for concentrated manures. The texture of such lands can be maintained either by the addition of green leaves or by the cultivation of green manure crops which are ploughed in. Under regular irrigation sources, a certain return is ensured and if suitable manure be applied its value is returned with interest.

8. *II. The systems under which farming is carried on and how this affects the demand and supply of manure.*—Dry lands except where very favourably situated as regards climate and rainfall are usually farmed by the owner of the land and unless he owns garden or wet lands he applies all his available manure supply to his dry land crops. Garden lands also are usually farmed by the owner of the land although there is a certain amount of leasing. Sometimes land is bought as a speculation and wells are sunk and the land is leased out at a fixed money rent. Thus all that the actual cultivator puts into the land in the way of industry and manure is to his own advantage. Having, as he does, to invest considerable capital in his cultivation, such a class of farmer is most calculating in his actions and it is not easy to persuade him to lay out money on concentrated manures ; when once he is convinced, however, that such manures pay, he is quite prepared to lay out money in their purchase. A good example of this is furnished in the efforts of this department to introduce fish manure to the garden cultivators of Coimbatore. Two seasons ago when the price of this commodity was particularly low, several persons gave this a trial paying for it at the rate of from about Rs. 1–4–9 to Rs. 1–7–6 an Imperial Maund, delivered at the nearest railway station. In all 567 bags or

about 21 tons were then sold. This year orders for 705 bags or approximately 29 tons of fish manure have been registered by the department from this tract subject to a maximum price. This maximum has varied from Rs. 2-8-0 to Rs. 3 a maund.

9. In wet land farming the conditions, under which farming is carried on, very greatly govern the demand for concentrated manures. Perhaps the commonest system is the "varam" tenure where the yield is divided on the threshing floor between the landlord and the tenant. Unless the landlord supplies the manure, which is seldom the case, it is not to be expected that the tenant will do so as the larger share of the crop value goes to the landlord. Another common lease is a fixed grain rent, but as this is usually an annual lease, conditions are not very much more favourable for the introduction of concentrated manures. The slightest sign of an increased yield means usually an increased rent, or another tenant; and naturally under these conditions the cultivator is not too anxious to show marked increases in his yield.

But everywhere where paddy is grown, a considerable portion of the cultivation is done under much more favourable conditions either by the owner himself or by tenants on a more certain lease tenure and it is in such places that the use of concentrated manures is likely to expand. In the first instance very careful work is necessary. The right class of ryot has to be found to make a start and when the start is made it must be followed up by finding others. Nothing strikes the enquirer more, when anything new is tried, than the indifference and lack of curiosity of the ryot to ascertain what innovation has been tried by his neighbour. Cases also have been known where people who have tried concentrated manures have deliberately misled their neighbours, fearing that the secret of their increased yield may lead to an enhancement in the price of the manure. Recently a ryot in a tract where plantains are extensively grown pointed out a neighbouring garden where the owner had by way of experiment tried groundnut cake as a manure but he could not say how much he had applied nor had he been to the garden to see what result the manure had had, although it was not more than 200 yards from his house, and from a distance the crop looked remarkably well.

10. *III. The attitude of the ryot to the use of concentrated manures.*—Although this view of the question has already been dealt with incidentally, it can be stated with certainty

that when once the ryot is convinced that a concentrated manure pays he will continue to use it, *i.e.*, if he is a genuine ryot. Many certainly expect too much from such manure and one of the chief objections raised is that the effect of such manures is not lasting. They admit that it gives a greater yield and that this increase more than pays for the manure, but being accustomed to bulky organic manures which have a lasting influence on crop production, there is naturally some disappointment when concentrated manures act differently.

11. *IV. The indigenous resources of the country in supplying concentrated manures.*—The following notes by the Agricultural Chemist detail the natural resources of this country for the supply of concentrated manures and include a summary of the processes for the utilization of atmospheric nitrogen for the production of artificial nitrogenous manures which offer considerable scope in Southern India.

THE MINERAL MANURES OF SOUTH INDIA.

12. The mineral resources of South India in so far as they have any agricultural application are exceedingly limited either on account of their quantity or their uneven distribution and the consideration of this subject is practically restricted to lime, gypsum, magnesia and phosphates. Potash also calls for some consideration owing to the large amount of saltpetre annually produced in India.

13. *Lime.*—Many soils in South India, of which those of the Nilgiris and the West Coast may be instanced as types, are very deficient in lime and would be greatly benefitted by heavy dressings of this substance. The soils of many districts and deltas although not depleted to the same extent as the instances given have a very low lime content and would be materially improved by lime manuring.

14. There is, consequently, a fair general necessity for applications of lime to soils, but unfortunately it is just those soils to which this refers that are most remote from the limestone deposits of the Presidency, and the difficulties arising from freight charges and poor internal communications militate against an extended application of the manure.

15. It is true that all round the coast shell lime is available and that in many districts burnt kankar may be relied upon as a source of supply, but both of these sources can only have a local value. The necessity of many districts can only be met by a cheap and abundant supply of lime which can only occur in areas where limestone deposits are

found, and these are both limited in area and not uniformly distributed through the Presidency. The largest deposits of limestone occur in Cuddapah, Kurnool and Guntūr districts and apart from these small deposits are found in the Trichinopoly and Coimbatore districts. Large specimens of calcite have been obtained in the Tinnevelly district but no knowledge regarding the extent of this deposit is available. Considering these sources of supply, it is probable that there is sufficient limestone in South India to satisfy the agricultural demand of the near future, but the cost of transport will always react against its use in requisite quantities in many localities, of which the planting districts of the West Coast may be taken as a type.

16. *Gypsum.*—The only deposits of any importance are those of the cretaceous formation of the Trichinopoly district. These could be utilised for the amelioration of such saline soils, to which the cheaper and more effective method of flooding and draining cannot be applied. There is, at present, no demand for gypsum for this purpose and such a demand can only arise through the agency of successful demonstration work. Even supposing that its application was found to be successful, the cost of transport would largely determine the extent of its use.

17. *Magnesia.*—The subject of the value of direct mangnesia manuring for crops is one which has received considerable attention during recent years, but it cannot yet be said that any clear principles have been enunciated. In certain cases magnesia manures have produced very greatly increased yields but in other cases the results have been negligible or even detrimental.

18. The action of these manures on the varied soils of this Presidency can only be determined by experiment, but if they were found to be successful the magnesite deposits of Salem ensure an abundant supply of the substance. It would, however, probably be found that instead of heavy dressings of magnesite or magnesia, very much smaller amounts of magnesium sulphate would have the same effect, and in this case the latter substance could be manufactured at the mines or some central works.

19. *Mineral phosphates.*—The only important deposit of phosphate is that in the Trichinopoly district where nodules containing calcium phosphate are found distributed irregularly through a bed of clay which is estimated to contain eight million tons of the mineral. Attempts appear to have been made in the past to utilize these deposits, but they have proved abortive

and at present there would appear to be no prospect of their being mined for export. A certain amount of surface working does, however, go on and the product is sold to certain manure firms in South India and utilized locally as flour phosphates.

20. The great difficulty presented is the fact that the mineral is of low grade quality and as such cannot compete with the better class deposits found in other parts of the world, or with bone ash, in the manufacture of superphosphates. These high grade phosphatic deposits are, however, undergoing very rapid depletion and as a consequence the attention of chemists has lately been directed to the introduction of new methods by means of which these low grade phosphates may be economically utilized and several of these methods are now being tried on a manufacturing scale with promising results. It is certain that before very long such deposits as those at Trichinopoly will be in demand and the question naturally arises, cannot Government arrange that these deposits shall be exploited for the benefit of India and that they shall not be allowed to be exported out of the country ?

21. Much of the land on which these deposits occur is Government property and it would thus be possible to prevent the latter contingency occurring by refusing to issue new licenses or to renew lapsed ones until some means are evolved which would make their utilization in this country possible. That such a possibility is more than probable is evinced by the fact that one of the latest methods is an electrolytic one which produces a very pure Basic super, and if successful, could be carried out in this Presidency where water power is available for the production of electricity.

22. The soil survey recently carried out in the adjoining Tanjore delta has shown that there is a great need for some form of phosphatic manuring in that locality and it is probable that these nodules used in the form of flour phosphate would be of some value. It is true that the availability of this manure is very low and that its utilization in this form would be wasteful in the sense that much would be dormant in the soil for several years, but such a method of manuring has the advantage of cheapness.

23. *Potash Minerals.*—With regard to the mineral resources in potash in South India it can only be said that they are non-existent and India, like all other countries, will be entirely dependent upon the potash mines of Stassfurt for the supply of this type of fertilizer if a large demand arises in the future.

24. It is true that there is a considerable production of saltpetre in India and this is probably capable of meeting the present demand of that substance for use as a manure, but apart from this any demand for purely potassic manures must be met from external sources.

INDIGENOUS MANURES OF SOUTHERN INDIA.

25. In considering this subject it is proposed to consider only the more important classes of manures from the following standpoints :—

(*a*) Variations in composition and their cause.
(*b*) Evidences of adulteration.
(*c*) Possible extensions in production.

26. By the term adulteration I do not wish it to be understood that I refer to intentional and fraudulent adulteration but rather that the term is used in a loose sense to cover the occurrence of impurities in the manures from any cause such as careless and uncleanly workmanship on the part of the producer.

27. The manures considered will be poonacs, fishmanures, bone products, farmyard manure, poudrette and saltpetre.

28. *Poonacs.*—The most important poonacs produced in this Presidency are castor, neem, groundnut, pungam, safflower and gingelly and in all cases considerable variations in composition are liable to occur.

29. *Castor cake.*—A number of samples from different parts of the Presidency have been analysed with the result shown in the following table :—

TABLE I.

Variations in the composition of castor cake.

	Average.	Maximum.	Minimum.
Nitrogen	6·37	7·60	5·38
Phosphoric acid ...	2·55	3·62	1·80
Potash...	·96	1·24	·65

30. The variation in these cases is partially accounted by the varying amounts of insoluble mineral matter (sand) found. Good samples contain only about 1 per cent. of sand but some of them contained as much as 5 per cent. These figures, however, sink into insignificance when compared with other samples, not included in the above, which were found to contain amounts of sand varying from 20—35 per cent.

31. This addition of earthy matter must undoubtedly be looked upon as an adulteration and whether brought about by

intention or through carelessness is to be guarded against. Dr. Lehmann, late of the Mysore Department of Agriculture, pointed out several years ago that a large proportion of the variation in composition which he found was due to the incomplete separation of the husk.

Neem or margosa poonac—

TABLE II.

Variations in the composition of neem poonac.

	Average.	Maximum.	Minimum.
Nitrogen	5·53	5·73	4·7
Phosphoric acid ...	1·36	1·63	1·2
Potash...	1·75	1·97	1·4

32. With this poonac too, abnormal samples have been examined which contained undue proportions of sand, as much as 31 per cent. being recorded in one case, whilst other samples, judging from the proportion of nitrogen, potash and phosphoric acid contained, had been adulterated by the addition of poonacs of inferior quality.

33. *Pungam poonac.*—Of the comparatively few samples hitherto examined, only one showed the admixture of an undue proportion of earthy matter, viz., $6\frac{1}{4}$ per cent.

The remainder gave the following results :—

TABLE III.

Variations in the composition of pungam cake.

	Average.	Maximum.	Minimum.
Nitrogen	3·95	4·00	3·91
Phosphoric acid ...	·77	·84	·64
Potash	·79	·94	·62

34. *Groundnut cake* has generally speaking been found to be of good quality. In no case has the amount of sand present reached $3\frac{1}{2}$ per cent., but on the other hand samples have been received which had the abnormally low nitrogen content of $6\frac{1}{4}$ to $6\frac{1}{2}$ per cent. In one case this was obviously due to incomplete extraction of the oil, but in the other cases it was impossible to determine the cause which might be due to inferior seed or to admixture with other poonacs.

The normal samples gave the following results :—

TABLE IV.

Variations in the composition of groundnut poonac.

	Average.	Maximum.	Minimum.
Nitrogen	7·92	8·63	7·36
Phosphoric acid ...	1·37	1·66	1·11
Potash	1·20	1·36	1·08

35. *Gingelly cake* has not shown evidences of impurity—

TABLE V.

Variations in the composition of gingelly cake.

	Average.	Maximum.	Minimum.
Nitrogen ...	6·23	6·58	5·76
Phosphoric acid.	2·21	3·36	1·54
Potash ...	·99	1·14	·79

36. *Safflower cake* showed considerable variation in composition but no evidences of earthy admixture—

TABLE VI.

Variations in the composition of safflower cake.

	Average.	Maximum.	Minimum.
Nitrogen	4·5	5·8	3·1
Phosphoric acid ...	1·2	1·5	1·0
Potash	·7	·8	·5

Two samples not included in the above appeared to be abnormal in composition as they contained a larger proportion of potash than phosphoric acid, whereas safflower cake showed the reverse ratio. They agreed in fact more with the composition of neem cake than safflower and may be looked upon as having been subjected to admixture.

Average composition of poonacs.

37. From the above results it would appear that the minimum values of good South Indian poonacs are approximately as follows :—

TABLE VII.

Minimum composition of South Indian poonacs.

	Nitrogen.	Phosphoric acid.	Potash
Castor	5·4	1·8	·7
Neem	4·7	1·2	1·4
Pungam	3·9	·6	·6
Groundnut ...	7·3	1·1	1·1
Gingelly	5·5	1·5	·8
Safflower ...	3·0	·8	·05

38. *Extension in the production and use of poonacs.*—Although large quantities of poonac are annually employed in the shape of manure in India, yet there is room for considerable extension when the large export of cakes and the larger export of whole oil seed is considered. This development can only be slow in a country where such a large proportion of

the cultivators neglect to manure their fields, but none the less some progress has been made in recent years. The slow progress is also partly to be accounted for by the rapid rise in prices during recent years which has prevented the poorer cultivators from using these manures, and partly by the system under which the land is let out to cultivators in certain districts.

39. Still there is no reason to suspect that India cannot produce sufficient poonac to satisfy all ultimate demands. The recent heavy demand for oils for manufacturing purposes has led to increased raising of oil-bearing crops and this will continue so long as prices warrant it, and in present conditions much of this seed will continue to be exported to other countries and the cake will thus continue to be lost to India. If conditions would only allow of it being done, the rise of a large oil-pressing industry based mainly on export of oil would tend to solve the difficulty.

40. Again there are many cakes produced in India, which have little manurial value, and consequently as yet are quite valueless. Yet these cakes enriched with some nitrogenous manure such as cyanamide, calcium nitrate, etc., which possibly can be produced cheaply in this country, would become effective from the manurial point of view, and thus make a cheap poonac available for the poorer cultivators. Pinnai and dupaka cake are of this type.

41. The enormous extension of the manufacture of artificial foodstuffs has led the older class of oil-consumer to search for new sources of supply with the result that many forest trees have been shown to yield oil-bearing fruit and which, if they could be exploited, would yield further quantities of poonac. Even if these poonacs are not of great value from the manurial point of view they could be made available by enrichment with artificial nitrogenous manures.

FISH MANURES.

42. Fish manures of whatever type constitute one of the most important classes of indigenous manures of South India, but the variations met with are so considerable that all the analyses made have been set down in detail.

43. *Fish guano.*—Of this seven representative samples have been examined with the result that it can be looked upon as a product of high purity. Of the seven samples six contained less than $3\frac{1}{2}$ per cent. sand and the seventh only $7\frac{1}{4}$ per cent.

Table VIII.

Variations in composition of Fish guano.

Number of sample.	Water.	Organic matter.	Mineral matter.		N.	P_2O_5.	K_2O.
			Soluble.	Insoluble.			
51/10	8·26	66·88	22·18	2·68	7·46	4·36	·47
276/10	12·74	57·59	27·35	2·32	8·46	8·66	·34
134/13	8·16	62·03	26·46	3·35	7·91	10·33	·48
177/13	9·35	61·25	26·31	3·09	8·01	9·75	1·05
313/13	7·87	56·30	34·15	1·68	7·88	13·49	·19
301/13	11·47	59·28	27·62	1·63	7·66	10·42	·66
162/14	8·01	62·42	22·30	7·27	7·11	8·82	·53
Average	9·40	60·82	26·62	3·14	7·78	9·40	.53
Average of the first six samples ...	9·64	60·55	27·34	2·46	7·89	9·55	·53

44. *Fish manure.*—Under this heading is classed manures which are not guanos and which consist of either whole or milled fish. Two tables are given : one gives the composition of good samples and one gives the composition of very impure products.

Table IX.

Variations in composition of good samples.

Number of sample.	Water.	Organic matter.	Mineral matter.		N.	PO .	K_2O.
			Soluble.	Insoluble.			
277/10 ...	13·47	64·49	15·18	6·86	5·83	4·81	·60
325/10 ...	10·52	72·39	16·35	·74	8·66	6·48	·61
326/11 ...	7·02	71·43	18·00	3·55	8·41	7·00	·27
209/13 ...	4·36	71·02	19·24	5·38	7·62	6·93	·90
314/13 ...	3·22	63·87	30·81	2·10	6·91	6·18	·73
52/14 ...	8·43	51·07	26·85	7·65	8·51	6·61	1·07
Average ...	7·83	66·71	21·07	4·38	7·65	6·33	·69

TABLE X.

Variations in the composition of poor samples.

Number of sample.	Water.	Organic matter.	Mineral matter. Soluble.	Mineral matter. Insoluble.	N.	P_2O_5.	K_2O.
				Sand.			
111/07 ...	15·05	48·96	14·39	21·60	6·15	5·31	·71
184/08 ...	10·13	53·83	17·38	18·66	6·79	2·81	·60
5/09 ...	9·56	60·16	14·39	15·89	6·39	5·12	·43
6/09 ...	7·18	65·99	13·42	13·41	7·31	5·36	·25
52/10 ...	6·47	48·03	14·47	31·03	4·38	3·99	·32
86/11 ...	6·57	43·36	12·23	37·84	3·53	3·15	·47
321/11 ...	3·86	32·17	24·82	39·15	1·26	3·31	·29
172/12 ...	5·74	55·08	6·31	32·87	6·37	3·43	·80
/13 ...	9·86	57·84	10·96	21·34	6·46	7·67	...
312/13 ...	7·59	59·66	21·05	11·70	6·79	10·39	·79

Pit fish manure.—Only two authentic samples of this product have been received.

TABLE XI.

Variations in composition of pit fish manure.

Number of sample.	Water.	Organic matter.	Mineral matter. Soluble.	Mineral matter. Insoluble.	N.	P_2O_5.	K_2O.
53/10 ...	40·38	36·55	18·14	4·93	5·59	2·11	·21
292/11 ...	5·06	20·35	29·42	44·67	2·86	2·07	·38

Prawn skins—

TABLE XII.

Variations in the composition of prawn skins.

Number of sample.	Water.	Organic matter.	Mineral matter. Soluble.	Mineral matter. Insoluble.	N.	P_2O_5.	K_2O.
175/14 ...	20·01	46·05	22·69	11·25	5·47	2·79	·55
174/14 ...	7·22	22·39	15·79	54·60	2·86	2·07	·38

Fish sand.—Only one sample of this substance has been analysed and its composition is thoroughly in accordance with its name—

Water	1·54
Organic matter	12·21
Soluble mineral matter	5·50
Insoluble do.	80·75
Nitrogen	1·18
Phosphoric acid	·38
Potash	·21

Fish guts—

TABLE XIII.

Variations in composition of fish guts.

Number of sample.	Water.	Organic matter.	Mineral matter. Soluble.	Mineral matter. Insoluble.	N.	P_2O_5.	K_2O.
293/11 ...	10·51	35·21	35·29	18·99	3·16	13·68	·13
294/11 ...	8·86	48·71	24·99	17·44	5·28	8·95	·31
320/11 ...	8·01	32·28	41·58	18·13	3·79	15·17	·04
Average ...	9·13	38·73	33·95	18·15	4·07	12·60	·16

45. *Conclusions.*—Fish manures, other than guts and prawn skins, prepared with due precautions to prevent admixture with sand do not contain more than 2 per cent. of insoluble mineral matter, but a very large proportion of commercial samples undoubtedly contain undue proportions of this adulterant. This is not, as a general rule, due to fraudulent intention, but is brought about by the crude methods dealing with the catch practised by the fishermen. Better conditions of drying and the systematization of the industry would go far to improve the quality of the product, but I am informed that one reason why inferior manures are so much in evidence in India is that exporters insist on obtaining the better qualities with the result that the home market remains the dumping ground for the remainder.

46. I am unable to draw general conclusions regarding the extension of the industry, but there is undoubtedly a considerable opening in one respect. So far as South Canara is concerned the guts of fish salted for food are made practically no use of and annually considerable quantities are either burned or thrown into the sea. These guts have a fair manurial value—*vide* Table XIII and some endeavour should be made to utilize them for manurial purposes.

FARM YARD MANURE.

47. Recently a bulletin was issued giving the results of the experiments conducted by the Department on different methods of storing manures. To this, nothing new can be added, but in the following tables are given the analyses of a number of samples of ryot's manure collected in different parts of the Presidency :—

TABLE XIV.

Composition of Ryot's Manure.

Number of sample.	District.	Water.	Organic matter.	Mineral. Soluble.	Mineral. Insoluble.	N.	P_2O.	K_2O	Composition.
302/09 ...	N. Arcot.	7·01	21·56	7·67	63·76	·55	·55	·13	Heap manure containing dung, ashes, straw and road sweepings.
304/09 ...	Malabar.	61·82	19·04	9·04	10·10	·60	·24	·17	Pit manure dung and leaves.
178/10 ...	Kistna	27·36	16·85	13·03	42·76	·47	·50	·79	Heap manure.
248/10 ...	Do.	8·31	20·82	16·64	54·23	·46	·73	1·40	Do.
249/10 ...	Bellary.	5·08	27·26	14·95	52·71	·59	·69	·96	Heap manure with ashes and sweeping.
250/10 ...	Do.	3·55	33·33	13·51	49·61	·77	·72	1·38	Do.
251/10 ...	Do.	21·06	17·98	12·84	48·12	·53	·60	1·37	Do.
252/10 ...	Do.	7·46	42·10	13·30	37·14	·91	·53	1·37	Do.
300/10 ...	Do.	25·03	15·42	14·32	45·42	·33	·49	1·10	Do.
256/10 ...	Kistna.	74·51	5·57	3·66	16·26	·33	·22	·30	Pit manure.
269/10 ...	Kurnool.	45·28	22·92	3·53	23·27	·76	·38	·80	Pit manure average of 10 pits.
287/10 ...	Tinnevelly.	19·97	8·80	11·85	59·63	·27	·49	·16	Heap manure with litter chaff and tank silt.
296/12 ...	Tanjore.	14·50	17·39	63·50	4·61	·55	·29	·38	

48. Without exception these manures are inferior to those produced on Government farms where reasonable care is exercised in storage and conservation and they show that the ryot has much to learn in this respect. In many districts fuel difficulties will always lead to a waste of the dung, but where such do not exist there is large scope for extending the use of farm yard manure and improving the conditions of storage.

Number of sample.		Water.	Organic matter.	Mineral.		N.	P_2O_5	K_2O_1	Remarks.
				Soluble.	Insoluble.				
190/09	...	20·07	6·58	5·09	68·26	3·66	1·24	0·09	Poudrette.
58/12	...	2·96	20·66	16·01	60·37	0·90	1·28	1·69	Do.
77/13	...	5·52	28·62	19·84	46·02	2·13	1·56	1·62	Do.
160/13	...	23·16	14·13	14·11	48·60	0·91	1·56	0·63	Do.
311/13	...	3·92	7·08	16·97	72·03	0·34	0·48	0·58	Do.
214/13	...	9·25	8·78	8·16	73·80	0·67	1·52	0·39	Do.
314/13	...	31·97	14·88	11·72	41·43	0·37	0·54	0·51	Municipal rubbish.
155/11	...	21·55	12·58	12·83	53·09	0·24	0·69	·65	Village sweepings.

POUDRETTE AND TOWN REFUSE.

TABLE XV.

Composition of Poudrette and Town refuse.

49. The samples of poudrette were obtained from various parts of the Presidency and show great variations in composition, but it is evident that with reasonable care a manure fairly high in nitrogen can be produced and one which would be of great value.

50. *Saltpetre.*—Saltpetre is produced to a considerable extent in many parts of the Presidency and, being a strong stimulative manure, is used for certain crops, particularly in the planting districts. With regard to the composition of this substance Lehmann pointed out that it is sold as refined, crude, or merely as saltpetre, and he found it to vary from 3·62 per cent. nitrogen and 17·9 per cent. potash to 13·61 per cent. nitrogen and 46·93 per cent. potash and considers that it should be compulsory for the dealer to give a guarantee of its value. Comparatively few samples have passed through this laboratory, but such as have done tend to support the above statement. This is only to be expected, when it is considered that the crude substance is obtained by the lixiviation of earth and consequently contains many impurities mainly in the form of chlorides. Thus the quality of the "refined" saltpetre produced from it is dependent upon the care and skill expended upon the refining process.

51. It seems probable that all the available sources of saltpetre in India which can be profitably worked, are now being exploited and that no great increase in the amount produced can be expected. This is unfortunate for it is an exceedingly valuable manure for many crops and at the same

time is in increasing demand for the manufacture of explosives, fireworks, etc. Under the secircumstances India must turn to the artificial methods of manufacturing nitrates for an increased supply.

52. *The Utilization of Atmospheric Nitrogen for the production of Artificial Nitrogenous manures.*—For the necessary supply of nitrogen for his crops the ryot has at his disposal poonacs, fish manures, green manures and green leaf manures, saltpetre, farm-yard manure, etc., but at present it cannot be said that they are utilized to the extent warranted by the impoverished cropping power of many South Indian soils. Although this is the case, there has been a steady rise during recent years in the price obtained for some of these manures and with an increasing demand on the part of the ryot these manures will probably command a higher price in the future unless there is a concurrent increase in the amount produced.

53. Poonacs are produced in quantity, but much is lost to the country owing to the fact that in the past economic considerations have favoured the export of every considerable quantities of whole oil seeds. The introduction of a large oil pressing industry based upon an export of oil would, if feasible, go a long way to meet future demands for poonacs. Fish manure is becoming more and more in demand for export and this in turn leads to higher prices and restricted use in this country. Green manuring will solve the problem in many districts but it is not applicable in many parts of this Presidency. A more general utilization of farm yard manure would be of the utmost benefit but against this militate fuel and other considerations.

54. These considerations lead one to turn for a partial solution of the problem to the new industry which has sprung up in other countries in recent years, namely, the production of artificial nitrogenous manures; for these substances could not only be used to enrich many poonacs which are of too small a manurial value to receive attention at present, but being in a concentrated form they could be utilized in districts where the cost of transport is a serious item of expenditure.

55. This industry has recently made great strides in the way of cheapness of production, and as it is mainly based on the use of electricity it appears to be applicable to this country. The feasibility of producing cheap electrical power in South India by means of water-power is one for Engineers to settle, but presuming that it is possible, the following brief

view of the methods employed in manufacturing these manures may be of some utility and for this purpose they may be classified as follows:

(1) The production of nitrates.

(2) The syntheses of ammonia and its compounds.

(3) The production of substances which readily yield ammonia.

56. (1) The production of nitrates is based upon the old observation that under the influence of the electric spark the nitrogen and oxygen of the atmosphere combine together to form oxides of nitrogen which form nitrous and nitric acids when dissolved in water. By varying the conditions it is possible to ensure only the production of nitric acid.

Of the processes which have proved successful the most important are the Birkeland-Eyde, the Schönherr and the Pauling all of which depend upon a single heavy current discharge in furnaces which are compact and simple in type. In all cases they are drawn out so as to form a flame—in the pauling process this is about 3 feet high—over which a current of air is drawn. The air on passing out of the furnace contains from 1—2 per cent. of nitric oxide which is converted into nitric acid during its subsequent passage through absorption towers filled with material over which water is allowed to trickle. A strong solution of nitric acid is thus obtained which is neutralized with limestone and then evaporated yielding the nitrate of lime of commerce. The yield of nitric acid is stated to be 60—75 grams per K.W.H.

Up to the present these electrical methods have been found to be the most economical means of preparing nitrates but, owing to the fact that the methods of synthesising ammonia are being rapidly perfected, much attention has recently been given to the economical formation of nitrates from that substance. The methods hitherto employed have been based on the fact that when a mixture of ammonia and air is passed over platinized asbestos, burnt pyrites, etc., oxidation of ammonia occurs with the production of nitric acid. These methods have not hitherto been developed to the extent of the electrical ones, but there can be no doubt that they will be of the utmost value in the near future.

57. (2) *The syntheses of ammonia and its compounds.*—When a mixture of nitrogen and hydrogen under high pressures is passed over certain substances at a temperature of 600—700 C it is found that some combination occurs and ammonia is produced. The reaction, however, is not complete, *i.e.*, all the nitrogen and hydrogen do not combine

together, and consequently, it is necessary to remove the ammonia thus formed and to subject the residual uncombined gases to a further treatment in the furnace. The process is, therefore, what is known as a continuous one, but the furnace employed is small and of comparatively simple construction.

A factory has been started by the Badesche Fabrik in Germany and without doubt great developments will occur in the future.

58. (3) *The production of compounds which readily yield ammonia.*—Several processes are in operation with more or less success for the production of substances which readily yield ammonia, but from the agricultural point of view, the chief interest centres round the manufacture of cyanamide or nitrolim, which is now a firmly established growing industry.

The manufacture of cyanamide is based on that of calcium carbide, but the production of the latter substance in this country offers no insuperable difficulties provided cheap electrical power is available for the furnaces. The production of cyanamide from the carbide is also a comparatively simple matter and consists in heating the latter in an atmosphere of pure nitrogen; when the nitrogen is absorbed and cyanamide produced.

The nitrogen is sometimes prepared by passing air over heated copper turnings, but more generally by the fractional distillation of liquefied air. The earlier types of furnace used were in the form of externally heated closed retorts connected to the nitrogen supply, but great difficulty was experienced in regulating the temperature. Now the reaction is started in the centre of the furnace by means of an electric resistance and the current is kept on until a certain proportion of the carbide has reacted, when it is shut off and the heat given out bythe reaction is sufficient to carry the process to a conclusion. The process of manufacture is therefore a comparatively simple one and one which could be applied in South India.

In a country such as South India where fuel is scarce there is always considerable difficulty met with in introducing new industries, but the manufacture of these synthetic manures being mainly based on a cheap electric supply does not fall into this category. Apart from the fact that they will help to satisfy the demand of the future for nitrogenous manures they offer a means of utilizing the water power of South India for purposes other than the production of power and this utilization of electricity is one which will be subject to enormous and varied developments in the future.

59. *The existing trade conditions for supplying concentrated manures.*—These are not satisfactory. The concentrated manure most commonly used by the ryot is poonac and the variation in analyses given in the above note show how grossly these are adulterated. Another difficulty is the fluctuation in price. The retail price of groundnut cake for instance as far as can be ascertained at the present moment varies from about Rs. 12 to Rs. 18 a candy in different parts of the Presidency. At present the trade is in the hands of numberless petty oil-mongers and merchants dependent chiefly on the local supply and until this is more centralised—and there are indications that this will come to pass—it is difficult to see how this can be improved.

60. Dealing with this question the Government Agricultural Chemist writes as follows:—

The adulteration of manures.—For many years there has been in this country a more or less sporadic demand for legislative action to prevent the adulteration of manures and to protect the interest of the cultivator. This demand has, however, mainly originated from the planting community of India, which mainly deals with responsible firms of manure dealers who issue guarantees, whereas the ordinary ryot of India has not hitherto used commercial manures in quantity or with intelligence sufficient to warrant such a course. This would appear to have been the attitude adopted by the Board of Agriculture in 1907, which, on the subject being presented to them for consideration, was of the opinion that the time was not ripe for the introduction of legislation on commercial fertilizers.

Since that time the rapid increase in the value of cereal crops and the activities of the department has stimulated a certain demand on the part of the cultivator for commercial manures and this demand seems very likely to increase rapidly in the near future. In these circumstances it would appear desirable to consider the question anew.

With regard to imported concentrated fertilizers of the type of chili-saltpetre, superphosphate, potassium sulphate, etc., the position appears to be fairly simple, for these manures are supplied by large organizations who have a reputation to maintain and who consequently will always give a reliable guarantee. It is rather with the indigenous manures such as poonacs, fish manure, saltpetre, bonemeal, etc., that proposals for legislation must centre around and where action may seem desirable.

In the previous paragraphs dealing with this class of manure evidence has been adduced which shows that consider-

able variations in composition occur which variations are not due to differences in quality of the materials used, but rather to such causes as the incomplete expression of oil, admixture with sand and earthy matter and admixture with inferior materials. Under these circumstances a strong case can be made on behalf of legislation designed to compel dealers to give a guarantee with all manures sold by them. The object of such a compulsory guarantee is twofold, on the one hand it enables the buyer to protect himself against fraud and to make sure that he is not paying too much for the article offered, on the other hand it protects the honest against the dishonest or careless trader.

However strongly the case for compulsory guarantees can be presented, such a guarantee is worthless unless independent means for checking it are in existence and to which the cultivator can readily refer. Of these means of control, South India is practically devoid and they must be created before any legislation can be operative. It is around this point that I apprehend that difficulties will arise.

Note.—Personally I do not see how such legislation can be worked satisfactorily at present.

[D.T.C.]

61. *The class of manures for which there is a demand or for which a demand is likely to arise.*—For garden land the ryot wants a general manure or at any rate a manure which will supply him with nitrogen and phosphates. His cropping is diversified and though he follows a rotation he may alter this to suit the season; for, although he has facilities for irrigation, this is an expensive item in his cultivation and he will often alter his cropping to utilize the rainfall as far as possible. Thus his requirements can best be filled by the use of indigenous concentrated manures of organic origin such as poonac and fish manure. It is only in special cases, such for example tobacco, that he will have to have recourse to other manures. This attitude will also very much simplify the extension in the use of artificial manures since, though often classed as literate, the farmer in this country is as loath to put his hand to a pen as in any other. Moreover, he has difficulty in expressing his views when writing in the vernacular.

The case for paddy is quite different. On wet land, rotations are only followed in limited tracts and paddy follows paddy year after year. The result of this has been the exhaustion of certain plant foods. Experience and experiment have shown that in this case it is phosphates which are required. Experiments are being made to test the availability of phosphates under wet land conditions. Though these have only been

conducted for one season at the Manganallur agricultural station, there is abundant evidence to show that superphosphate gives immediate results and is much more readily available than either bone meal or flour phosphate when the same quantity of total phosphate is applied.

The following average increases of paddy were recorded last year:—

	Actual increase in pounds per acre.		Percentage increase.	
	Grain.	Straw.	Grain.	Straw.
350 lb. superphosphate.	800	1,020	121·0	104·6
250 lb. flour phosphate.	413	325	58·0	40·625
250 lb. bone meal.	167	242	23·5	30·25

It is often stated that the effect of superphosphate is to increase the yield of straw rather than the yield of grain.

The following figures show the percentage of grain to straw in duplicate experiments:—

	Percentage.
Check	70·6
Super	81·1
Check	63·7
Super	64·3

Where super has been applied in addition to green leaf manure, similar results have been obtained when small quantities of super (120 lb. per acre) have been applied. The percentage of grain to straw being as follows:—

	Percentage.
Check (leaf at 2,000 lb. per acre)	82·7
Super and leaf at 2,000 lb. per acre	83·10
Check (leaf at 2,000 lb. per acre)	98
Super and leaf at 2,000 lb. per acre	105·4

Where the quantity of super has been doubled, *i.e.*, 240 lb. per acre, the results show that the straw has been unduly increased. The percentage of grain to straw in this case is as follows:—

	Percentage.
Check (leaf at 2,000 lb. per acre)	90·1
Super and leaf at 2,000 lb. ,, ...	57·5
Check (leaf at 2,000 lb. ,, ...	122
Super and leaf at 2,000 lb. ,, ...	88·3

Some of the complaints made on this point could very probably be ascribed to the increase in yield of both grain and straw, which in many places would naturally protract the harvest period and thus result in much grain being shed by the crop becoming over ripe.

Results at the Central Farm, Coimbatore, also seem to indicate that superphosphate rather than depressing the

proportion of grain to straw increases it as the following average of five years' results show :—

	Percentage of grain to straw.
Check no manure	93·7
Check Sunnhemp green manure	88·2
Super 1 cwt. and Check Sunnhemp green manure	98·6
Super 1 cwt. and K_2 SO_4 1 cwt. and Check Sunnhemp green manure	80·6

It is to be noted that the addition of the potash manure at once depresses the proportion. The value of fish manure as a paddy fertiliser has not really been tested by the department but it compares very favourably with bonemeal as the following average yields obtained in manurial experiments at the Central Farm, Coimbatore, show :—

	Grain.	Straw.
Bonemeal at 500 lb. per acre, average yield for 6 years in pounds per acre	2,947	4,525
Fish manure (miled fish or whole fish) at 560 lb. per acre, average yield for 5 years in pounds per acre	3,196	4,433

The matter of manuring wet lands has been fully discussed in the following note by the Government Agricultural Chemist.

62. *Manuring and cultivation of paddy.*—Although rice in one form or another constitutes the main food of a very large proportion of the inhabitants of the world, yet, compared with other cereal crops and with the importance of paddy, comparatively few investigations have been carried out to determine the best manurial and cultural requirements of the crop. This fact is remarkable, for the conditions under which swamp paddy is grown are so opposite in character to those of dry crops as to merit widespread attention ; but this is possibly because scientific investigation is only of very recent development in the countries where paddy is grown.

63. The results of such investigations, as are available, show distinctly that these peculiar conditions of cultivation coincide with peculiar manurial requirements on the part of the crop. The problem is complicated by the fact that paddy is grown under conditions ranging from that of swamp cultivation to that under dry conditions similar to ordinary crops, so that it is impossible to lay down hard and fast principles which will cover all circumstances.

64. With dry paddy the manurial and cultural requirements will be practically the same as for ordinary cereal crops, but these will be modified as the conditions become moister

until the extreme case of swamp cultivation is reached, and it is with these extreme conditions that this note is mainly concerned.

65. The first point taken for consideration centres around the general requirements of the crop with regard to nitrogen phosphoric acid and potash. Paddy being a cereal, the general requirements of that class are found to hold good in so much as it responds readily to the application of nitrogen and phosphoric acid. Any of the phosphatic manures may be used and superphosphate, basic super and basic slag used in comparatively small quantities give excellent results. The slow acting manures of the type of bonemeal are also effective when used in fair quantity and applied annually.

66. With regard to potash the position appears to be fairly simple as the experience of both Madras and Hawaii is that no special manuring is either necessary, or desirable, unless the soil is very deficient in this ingredient. In fact it would seem that unless absolutely necessary an application of potash results generally in diminished yields. It is difficult to fix a value for the available potash in a soil below which potassic manuring is desirable. The value is much below the accepted one of ·01 per cent. and is probably about ·005 per cent. Certainly potassic manures have proved effective on soils having a content lower than ·005 per cent.

67. The main point of interest undoubtedly centres around the use of nitrogenous manures and particularly with reference to the best form in which to apply this ingredient. With dry crops good nitrification of the nitrogen is essential, but this process can only occur in soils which contain an abundant supply of oxygen and in which the moisture conditions are suitable, *i.e.*, neither too dry nor containing too much water. Unlike dry soils, paddy soils are saturated with water and the amount of oxygen they contain is therefore inconsiderable and under these circumstances nitrification cannot proceed and the crop must as a consequence absorb its nitrogen in some other form than nitrates. Much work has been done on this point and it is now quite clear that swamp paddy takes up its nitrogen mainly in the form of ammonia and consequently ammonium sulphate is a suitable manure to use. The same applies to "nitrolim" or cynamide and the bulky organic manures which readily decompose in the soil with the production of ammonia.

68. On the other hand the use of nitrates such as saltpetre, chili-saltpetre and calcium nitrate have been shown to be unsuited for swamp paddy. Not only do nitrates as such

constitute an unsuitable form of manure and one which is utilized very indifferently by the crop, but the absence of oxygen in the soil brings about denitrification, resulting in the actual loss of nitrogen or in the production of nitrites which have an intensely toxic action on the crop. It may be noticed in passing that this relationship offers some justification for the general practice of allowing paddy soils to remain fallow during the dry season. Such a practice retards nitrification during this period so that when the land is flooded there is little loss of nitrogen or production of toxic nitrites, and furthermore, the crop of weeds produced at this time yield a supply of nitrogen in a form very suited to the requirements of the crop. It is also interesting in this connection to note that the Hawaiian authorities as a result of these experiments recommend fallowing in the off-season.

69. Although nitrates are unsuited to paddy grown under swamp conditions it is probable that applications of these manures at suitable times to crops grown under dry conditions or to crops which are under dry condition for a portion of their growth, may be of great benefit. This is a point worthy of experiment on rainfed and hill paddy.

70. Apart from the mere elucidation of the general manurial requirements of the crop it becomes a question of great importance to determine the relative values of the different nitrogenous manures. Should preference be given to the concentrated manures or to the bulky organic manures of the type of green manure, poonacs and fish manure? A solution to this question is offered by a study of the physical and biological characters of these soils which have recently been shown to possess a most important function in determining the value of the yield of the crop.

71. In the first place, drainage has been shown to be an important factor with reference to the amount of crop produced. When compared to undrained condition the effect of increasing drainage is to improve greatly the yield, but only up to a certain point beyond which a rapid decrease sets in, until yields lower than those from the undrained soils are obtained. Thus in these swamp paddy soils there is an optimum rate of drainage which the cultivator should aim at obtaining in order to obtain his maximum yield. Instances of this peculiar action of drainage are not wanting in South India. In the comparatively new Periyār delta the rate of drainage is generally too high and as a consequence the crop suffers and there is an undue consumption of water. On the other hand the Tanjore delta may be taken as

representing the type of soil in which the rate of drainage is too low and which would give increased yields if means could be found to induce an improvement in this respect. The well-known fact that several years must elapse after dry land is converted into wet soil before good crop can be produced is also another instance.

72. It must be carefully borne in mind that the whole tendency of paddy cultivation owing to the puddling of the soil is to make the soil finer in texture and so to reduce gradually the rate of drainage. Up to a certain point this is advantageous, but when that point is exceeded a diminishing outturn follows and steps must be taken to counteract it. In this connection the value of bulky organic manures and particularly green manures become at once apparent for these manures have a beneficial action on the physical properties of a soil on the one hand tending to increase the water holding capacity of open soils and on the other to improve the drainage of heavy soils.

73. The explanations put forward to explain the action of drainage are twofold. One claims that the action is due to the removal of toxic substances produced during the decomposition of organic matter, in the soil by means of the drainage water, and the other that drainage improves root aeration thus permitting of deeper root development and increased cropping. It is probable that the real explanation must be based on both theories, for, in undrained soils, such as those of part of the Tanjore delta, green manures have undoubtedly a toxic action which militates against the introduction of these manures into that district.

74. The aeration theory, unlike the toxin one, explains the peculiar effect of drainage on the cropping, but in addition, throws a new light on the root development of the crop and brings additional arguments forward in favour of the use of green manures :—On the surface of the soil where the soil and water are in contact, there forms an organised film containing green algae, diatoms and various bacteria existing together under symbiotic conditions. The algae and the diatoms decompose the carbon-dioxide dissolved in the irrigation water and produce bubbles of pure oxygen. In addition any marsh gas, which arises from the decomposition of organic matter in the soil, is oxidized by the bacteria present in the film to carbon-dioxide, which in turn is decomposed by the other organisms with the liberation of oxygen. Thus the combined action of the organisms in the film is to concentrate pure oxygen at the surface of

the soil which in turn is dissolved in the water entering the soil through the action of drainage. This ingoing water is consequently much more completely oxygenated than is the surface water and is utilised for the aeration of the roots. With increasing rates of drainage this aerated water can penetrate deeper and deeper into the soil thus permitting deeper root action and better cropping power. This action can go on only so long as more oxygen is produced than can be dissolved in the drainage water and when that point is passed the water becomes less proportionately aerated, and root action is decreased, and the crop suffers in a like ratio. The main point however is that the greater the volume of Methane produced in the soil the greater is the amount of oxygen available for root aeration, and consequently the use of green manures, etc., tends to increase the root development of the crop and to lead to better cropping.

75. The results of these investigations demonstrate clearly the most important part played by organic manures in paddy cultivation, not only from their direct manurial value, but also from their effect on the physical and biological characters of the soil, and therefore, their general utilization cannot be too widely extended. Used in conjunction with some form of phosphatic manure they probably fulfil all the requirements of most South Indian soils.

76. In conclusion, the following general conclusions may be laid down :—

(1) Swamp paddy requires nitrogen to be supplied to it in the form of ammonia or in the form of substances which yield ammonia on decomposition in the soil.

(2) Nitrates are unsuited for the requirements of the crop.

(3) Phosphates are generally valuable manures.

(4) Potassic manures are generally not required.

(5) Bulky organic manures fulfil all the requirements regarding nitrogen and in addition they re-act beneficially on the crop by affecting the biological and physical characters of the soil.

(6) Generally the best results will be obtained by a system of green manuring in conjunction with phosphatic manures. For this purpose bone-meal is suitable.

77. The following note deals with this subject as it affects the planting community :—

The three main crops grown in the planting districts of South India are coffee, tea and rubber.

It has been the practice for many years to manure coffee heavily. At one time a mixture of bones and poonac was almost universally used, but during the last ten years the planters have learnt the value of potash for coffee and now it is usual to apply each year a complete fertilizer. There is now a growing tendency to manure this crop in a systematic way so that the fertilizers applied in any one year have a distinct scientific relation to those applied in the past on the one hand, and those it is intended to apply in the future on the other.

Tea was originally planted in rich virgin jungle soils and did not at first require manuring. The time comes sooner or later, however, when if the high yields and quality of the tea obtained is to be maintained, manuring becomes a necessity. This stage has been reached on most of the tea gardens in South India and, in nearly all the tea districts, manures are being given to this crop annually. The usual custom is to apply a general fertilizer with phosphoric acid and potash in a readily available form just before pruning and afterwards a similar manure with a larger proportion of available nitrogen. This system has given excellent results both in increased yield and quality.

Rubber is a comparatively new industry but the value of manures has been realised and most estates now manure the trees heavily. More experimental work is needed however before any definite statements can be made as to the best mixtures for this crop.

Minor crops such as pepper and cardamoms are not manured systematically as a rule, but it may be said that there is a growing tendency towards intensive cultivation and the heavy manuring of all crops.

With regard to special fertilizers, nitrolim and nitrate of lime are gradually grown in favour. The former in general mixtures with basic slag and sulphate of potash has given some good results on coffee, especially in Coorg.

The South India soils in planting districts are almost all markedly deficient in calcium carbonate content so that basic manures like those mentioned above, and basic slag, and basic superphosphates, give the best results, while fertilizers like sulphate of ammonia which not only depend upon the presence of calcium corbonate in the soil to become effective but at the same time deplete the soil of this constituent cannot be used at all.

All the soils respond in a marked way to periodical liming, but the price of lime is high and this work is expensive. There are a few local deposits of limestone in

Mysore State and the Nilgiris but there are difficulties in the way of acquiring these and working them and the usual practice is to obtain shell lime from the coast, the transport of this over long distances often making the cost of liming almost prohibitive. Anything which can be done to develop local deposits of limestone, or to cheapen coast lime would be of great advantage to the estates.

The general practice among planters is to buy all fertilisers on a guarantee. These guarantees are occasionally checked, when time and occasion permits, by the Scientific officer and his Assistant in Mysore. On the whole the system works in a satisfactory way and it is seldom a manure is found to fall below the guarantee. When it does so the supply firm is always willing to give compensation.

The only outstanding difficulty is with fish manure. Ordinary milled fish is apt to contain a large amount of sand and this quantity has undoubtedly shown a tendency of late years to increase, one sample analysed containing as much as 35 per cent. of sand. A protest was made about this at the annual meeting of the United Planters' Association in 1913 and the suppliers were approached and asked to guarantee that the fish supplied should not contain over 5 per cent. of sand. This they were unable to see their way to do and consequently only high grade fish guano is now bought by most planters.

Though there may be practical difficulties in the way of producing a milled fish free of sand, these excessive amounts almost amount to adulteration and it would seem as if some way of avoiding them could be found. Where the fish has to be transported over long distances to the estates the amount of sand in it becomes increasingly of importance.

The following are the guarantees chiefly used :—

Fertiliser.	Guarantee—Percentages.		
	Nitrogen.	Phosphoric acid.	Potash.
A. Nitrogenous fertilisers			
Groundnut poonac	7—8	...	...
White castor poonac	5—6	...	...
Black castor poonac	4—5	...	...
Hongay poonac	4—5	...	...
Neem poonac	4—5	8	...
Fish guano	8—9	...	...
Blood meal	11—12	...	...
Nitrate of soda	15—16	...	...
Nitrolim (in drums)	18	...	
Nitrate of lime	11	...	...
B. Phosphatic fertilisers.			
Fine bone meal	4	22—23	...
Steamed bone meal	3—3½	23—25	...
Superphosphate	...	15—17	...
Concentrated superphosphate	...	42—45	...
Basic superphosphate	...	13—14	...
Basic bone superphosphate	2½—3	15—17	...
Basic slag	...	17—20	...
C. Potassic fertilisers.			
Sulphate of potash	...	...	48—50
Muriate of potash	...	...	50—52
Nitrate of potash	9—10	...	30—35

I. What steps can be suggested for the greater utilisation of indigenous manures within the country ?—Figures published in the *Quarterly Journal of the Indian Tea Association* show that during 1912-13, 110,221 tons of bones worth £525,739; 21,408 tons of fish manures and guano worth £69,414; and 2,235,703 tons of oil cakes worth £821,387 were exported from India.

This matter has been before the United Planters' Association of Southern India for several years. At the annual meeting in 1913 a special committee of the association which had been appointed to go into the matter reported as follows :—

"Your committee, after considering the question of the "export of bones and indigenous fertilisers, is of opinion that "this association should request the Board of Agriculture in "India not to lose sight of the importance of cheap manures "to all classes of agriculturists, and suggests for its

"consideration the imposition of an export tax on indigenous "fertilisers, as we are of opinion that such a tax, even if it "fail to reduce the local price, will provide funds which "could be devoted to the encouragement of both the manu- "facture of superphosphates and the oil crushing industry."

II. How could relations between manure merchants and the Agricultural Department be improved? —As far as the scientific department of the United Planters' Association of Southern India is concerned they endeavour to keep in as close touch with the firms supplying manures as possible. Experience is constantly exchanged between the scientific officers of the department and the managers and chemists of the firms, to their mutual benefit.

In 1910 Messrs. Parry & Co. sent their chemist on a small tour with the Scientific Officer of the Planters' Association so that he should be able to study local requirements and difficulties of transport, etc., on the spot.

In 1912 the Kali Syndicate offered the United Planters' Association an annual subsidy to enable them to carry out manurial experiments in Coorg and Mysore with coffee and ceara rubber. The objects of these experiments were, to discover by experiment the best forms of potash to use in conjunction with phosphoric acid and nitrogen; the best quantities of these fertilisers to apply; and what effect potash might have on the growth and yield of ceara rubber.

The offer was accepted and a number of experiment plots were laid down on different estates. This scheme has now come to a sudden stop, the Kali Syndicate being a German firm but is quoted as showing the kind of plan adopted by the planters to get into as close touch as possible with firms supplying fertilisers.

At the present time there would appear to be an excellent opportunity of developing the trade in, and of the use of, indigenous fertilisers such as bones, poonacs, fish and nitrate of potash and the planting community would welcome any movement in this direction. It is as a rule a matter of price. When the unit value of indigenous fertilisers rises for any reason above that of imported manures the latter are naturally purchased. Could the price always be kept below imported material, indigenous fertilisers would always be given a preference on the estates.

78. *Soil Surveys.*—Soil surveys have been completed for the Tanjore and Guntūr deltas. The results of the first have been published. The results of the second will be shown at the conference.

SUMMARY OF THE DISCUSSION ON MANURES.

Before the consideration of the items in the Agenda paper was commenced several members, *e.g.*, Mr. Chatterton and some of the firms, stated that they agreed with Mr. Harrison that the manufacture of Nitrolim or Cyanamide in Southern India was possible and ought to be profitable. It was a question within what time the Indian ryot would learn to use artificial fertilisers on a considerable scale, as a large output was necessary to make any such plant pay. The output in Sweden runs to thousands of tons.

Mr. Chadwick then introduced the subject of the greater utilisation of indigenous manures within the country and the steps which could be taken to foster their use. On the question of favourable rates on railways being raised the discussion became somewhat discursive but useful information was obtained. The South Indian Railway already give exceptionally favourable rates for manures although the total quantity carried last year was only 16,000 tons; in fact the Agricultural Department had always found them very ready to help. Mr. Armstrong said they had also given special facilities for sulphuric acid. Mr. Subbaraya Ayyar of Madura said that the difficulty was not so much with freight but due to shortage of waggons, which the representatives of the railway companies said could to some extent be mitigated if consignors would endeavour to move as much stuff as possible in the slack season. When manures are competing with grains or other food-stuffs for transport, preference is necessarily given to the latter. There ought to have been no delay in Madura in July. There might be in June. The railways would only be too thankful to obtain forecasts of what waggons would be likely to be needed, a few months in advance, but most endeavours to obtain such information had failed. Several of the members drew attention to the fact that bulky fodders were in a very similar situation to bulky manures in the question of transport. Both fodder and manure are needed as cheaply as possible in order to increase general production. Mr. Chatterton and Mr. Chadwick both said that they had seen large quantities of hand-baled fodder carried on the Bombay-Baroda Railway and Mr. Subbaraya Ayyar maintained that if paddy straw be pressed and baled there would be a considerable demand for it in the black cotton soil of Madura-Ramnad as well as elsewhere. Mr. Cross said he would make a note of it and would gladly consider any suggestions that were likely to be put before them.

The next difficulty raised was whether railways could give lower rates for small consignments of concentrated fertilisers or special manures. This is the greatest difficulty at present. Mr. Sampson explained another difficulty which was met with in practice in introducing the use of such fertilisers including fish manures or cakes and that occurred with ryots who live a little distance from the railway. The firms consign the railway receipt to these ryots by V.P.P. but the ryots frequently do not get that receipt until after the goods have reached the railway station. On taking delivery they are thereupon charged demurrage which sometimes exceeds the cost of freight or even the cost of the manure. In answer to these difficulties the railway representatives showed that on their side the difficulty which prevents them from giving entirely exceptional rates for very small consignments of fertilisers was that many of the latter were possessed of such an offensive smell that it was necessary to make special arrangements for their carriage; and consequently such transport became costly. The second difficulty also was beyond the control of the railway; it lay with the post office. But the South Indian Railway had very considerately agreed to refund such demurrage charges in cases in which the Agricultural Department was able to certify that a manure on which charge had been made was a particular one recommended by themselves for a particular purpose in order to persuade the ryots of the value of such a fertiliser, but if such cases became very numerous it would be impossible to continue such a concession.

There were thus railway difficulties in the way of carrying small quantities of new fertilisers although the railways were willing to do everything they could to encourage the use of manure. Yet it is impossible to expect ryots to buy large quantities in the first instance. The Madras and Southern Mahratta Railway had through concession rates for fish manure in bulk from the west coast to Poona and would certainly quote one for Gōdāvari and Kistna if there appeared to be any opening. Phosphates in Tanjore delta and fish manure in Coimbatore were instances of good openings. The remedy that appealed most generally to all interests present at the conference was the establishment of pioneer manure depots largely under the control and the direction of the Agricultural Department in tracts in which these officers were prepared to recommend certain kinds of manures. The Registrar of Co-operative Societies also stated that as soon as it was known for what classes of manures there was a market he would be ready to get the co-operative societies

to manage their own depots. Mr. Bawden was also ready to help on any such lines. Discussion then occurred as to the lines on which the Agricultural Department could undertake the management of such pioneer depots. They must not be asked to stock and push the sale of every variety of fertiliser that may be on the market. They can only undertake to push the sales of the class of fertilisers which they believe to be suitable for that tract. The representatives of the firms present agreed to support and work in with such depots; and Mr. Chatterton asked whether they were prepared to agree definitely not to undersell the Government depot working in that tract. It was understood that all firms were prepared to supply the needs of such depots at rates below those which they would charge to ordinary purchasers. Mr. Stanes, Mr. Barnard and Mr. Christie all signified their willingness to help in this. On raising the question whether the department will sell these fertilisers as agents of these firms or buy them outright before stocking them both the firms and Mr. Chatterton who had had some experience of depots said that the latter course was distinctly preferable. The officers of the Agricultural Department were convinced that in certain tracts there are more extended openings for such manures than is generally believed and that their use therein would amply repay their cost. Both Mr. Buckley and Mr. Chadwick thought that some such scheme of depots might well be worth a trial and the department was prepared to try and work out the details for some tracts as soon as possible. Mr. Christie asked that firms would be informed if and when further openings appeared.

Mr. Chatterton agreed with the planters in their request that all export of bones from India should be prohibited but he was unable to carry the general sense of the meeting with him.

The next point considered was how to improve the relations between the merchants and the Agricultural Department, and Mr. Chadwick opened this by asking them whether soil surveys such as had been done for Tanjore and Guntūr were of any real assistance to them. The maps of the soil survey of the Tanjore and Guntūr deltas were handed round and were exceedingly favourably received. They take a considerable time and a large quantity of work to prepare and in view of this representatives of firms were asked to state whether they found such maps so useful in their regular work as to justify continuing to prepare them. Messrs. Stanes & Co., and Binny & Co. (Limited), said that this was

the first time they had heard of the existence of such records and they desired as also did Messrs. Parry & Co., that the work should be continued certainly for delta lands. They were very marked limits to the utility of chemical analyses of soils and Mr. Chadwick asked that if any case occurs in which the information in these records is being twisted in a wrong manner and circulated among the ryots he might be informed thereof. This discussion provoked a somewhat discursive conversation among many of the landholders present as to the utility and limitations of these chemical analyses and Mr. Seshagiri Rao was understood to say that he had little faith in it whilst others urged that dry lands should be more thoroughly analysed. Already all samples of soil sent by cultivators to the Agricultural College are analysed free and a report with advice returned to the applicant. A copy of this is also sent to the local agricultural officer so that if the applicant be in doubt as to how to apply the advice given to him by the chemist he can apply to the Deputy Director of Agriculture at once for assistance. Until the use of fertilisers becomes very much more general there was little object in attempting a systematic soil analysis of dry land and it is not proposed to undertake it. Wet lands are usually more uniform in character and the larger areas will be first taken up. The scattered analyses of dry lands which Mr. Harrison has already on record in his office as the result of the applications from private ryots are not of very much use for forming an opinion of the needs of the neighbouring dry lands because a ryot usually only sends soils of his worst fields for analysis. It is only when he is at his wit's ends what to try to do to render his field profitable that he sends samples of soils for analysis. Mr. Adinarayana Ayya hoped that the chemical branch of the College would be increased, and was told in reply that allowances for this had been made.

In the way of interchanging experience Mr. Christie said that the firms would be perfectly ready to communicate results of any of their trials on ryots' lands to the department confidentially, stating what had been used and in what quantities. Mr. Barnard and others agreed. It was understood that the other firms also would be prepared to do the same and the department would keep all firms informed as to the results of any experiments made by them. Mr. Chatterton especially requested that experience with fertilizers should be consolidated and thrown into better form both for following results and seeing what actually had been done than is the case at present.

On the matter of credit sales for manure several of the landholders present pointed out that a loan for the purchase of manure repayable at harvest time is often of the greatest use to the ryot. Both Mr. Chatterton and Mr. Subbaraya Ayyar advocated the necessity for simplifying procedure for obtaining such loans so that purchase on credit might be made at any of these depots and if necessary the balance would be recoverable as an arrear of land revenue. It was very doubtful whether the Agricultural Department had the staff to deal with loans even if they were competent to do so. Moreover, loans for manures could always be obtained from the Co-operative Society if there was one in the village.

The conference was practically unanimous that the time had not yet come when it would be possible to prescribe that fertilizers could only be sold under certain guarantees and subject to certain standards. Most of the larger firms which deal in concentrated fertilizers already on their own initiative sell subject to guarantee. But the charges of private analysts for checking these guarantees are very high. The Government Agricultural Chemist could not undertake to check every case free. But the chief difficulty arises when dealing with poonacs from all the small oilmongers of the country for which it seems impracticable to enforce standard. The firms definitely declined to give any public statement of ingredients in their mixtures. They had no objection to informing the officers of the department confidentially as to the composition of such mixtures but they did not wish to have them published. All agreed in this. But to the publication of bare chemical analyses they had no objection.

Occasionally applications are made to the Department of Agriculture to arrange trials of ryots' lands of special fertilizers for special crops. On this Mr. Chadwick wished to say that they were only prepared to do so in cases in which they were sure that in the event of the trial being successful sufficient stocks would be maintained to meet all possible demand and they must not be expected to be ready to try anything as a matter of course that anybody cared to send to them in any place they wished. Mr. Bawden said that if this system of depots materialise he was prepared to help to manage one. Mr. Subbaraya Ayyar, Mr. Seshagiri Rao and several other gentlemen all asked that more demonstrational work should be done both with indigenous and concentrated fertilizers on ryots' lands.

Mr. Barnard handed in a written statement which covers most of the points of reference and is printed here.

I believe that whatever can be done to enable the Indian agriculturist to realize the value of the supplies of manures obtainable within the country is for his benefit and the lasting good of India. At present very large quantities of bones, fish manure and poonac are being exported, and I do not think it is stating the case too forcibly if I say that this is because the cultivator does not sufficiently realize the value of these manures; the quantity exported is precisely that portion of the supplies for which there is no market among the agricultural public in this country. The firm I belong to—Messrs. Parry & Co.—have in recent years done a great deal to assist in making these concentrated manures known to cultivators. I may say that all we have exported has been that margin of our supplies which we have been unable to dispose of in this country. We have been associated with the work in manuring that the Agricultural Department is doing, Our plan has been to assist ryots in drawing up schemes of manuring and our advice has generally been in the direction of supplementing the supplies of country manures which they have available with concentrated fertilizers. In offering our advice in this way we have not been blind to the many factors which have to be considered. We endeavour to find out as far as possible the nature and conditions of the soils for which we are asked to supply manures and other points connected with the local agricultural practice; having regard to the various types of solis to be found in India and the differences in agricultural practice and natural fertility to be met with in the several districts we have found this to be necessary in order to obtain successful results. For the purpose we have a laboratory, a trained staff of chemists, European and Indians, including a diplomaed agriculturist of Saidapet College. I am glad to say that we are working on the same lines as the department. Concentrated manures are mainly useful in supplementing organic manures and are of the greatest value in helping to maintain the mechanical texture of soils, and, generally speaking, our experience has been to find a great need of phosphates. We find that superphosphates give immediate results and are more available than bone meal or finely ground raw mineral phosphates. An important consideration in this connection, which has determined our line of action, is the percentage of lime contained in the soil. We find that acid superphosphates, as might be expected, do not produce well on soils which are deficient in lime. On such soils, however, if basic manures like basic superphosphate, precipitated bone phospate and basic bone

superphosphate are used in comparatively small quantities, excellent results are obtained. For use in conjunction with any system of green manuring, we have found that bone meal is only slowly available and the best phosphates to use with green manures are manufactured bone phosphates such as those I have mentioned.

In regard to the utilization of atmospheric nitrogen for the production of artificial nitrogenous manures mention has been made of nitrolim. We find nitrolim to be a suitable means of supplying nitrogen to delta lands deficient in lime, for which purpose I agree that nitrolim has probably a great future. In the meantime, however, ryots have not yet learned to appreciate it and its application requires some special care.

As to the suggestion to manufacture nitrolim in this country, it has to be remembered that any such undertaking would have to compete in the matter of selling price with other countries which are possibly more favourably situated in regard to cheap power and cost of raw materials; a very important consideration also is the quantity to be produced. On the basis of a small production, I venture to say nitrolim cannot be manufactured profitably. With a demand for it in this country that could be measured in thousands of tons annually the production of nitrolim say in Mysore State would probably be worth full consideration, for if the consumption should reach such figures, a further large increase could naturally be expected. In Norway and Sweden I understand hundreds of thousands of tons of nitrolim are produced annually and production on this large scale is found necessary for economical working.

I would say the prospects of a nitrolim industry in this country as well as the desired stoppage of the export of indigenous manures depend altogether on the Indian agriculturist being made to realize their respective values. This teaching can best be done by means of further experiments and demonstrations in different parts all over the country with special reference to the needs of particular soils and crops.

Manure merchants have been benefited by the great strides which agricultural science has made in the last twenty years or so, and, whereas formerly it was common for a manure manufacturer to offer a fertilizer as suitable for any soil, he is now careful to arrange that the manures supplied are suitable for individual soils.

I think the Railway companies could also help in this direction by granting favourable rates of railage on small consignments of manures for trial purposes. This would

tend to induce ryots to experiment largely and bring about the day when the demand will be sufficiently developed to enable manure merchants to rail wagonloads and keep stocks at distributing centres. The South Indian Railway already carry green manure at reduced rates and have granted this concession in the case of concentrated manures also that is, they have agreed to accept small consignments of concentrated fertilisers at the rate they charge for carrying green manure. I hope it may not be long before the Madras and Southern Mahratta Railway see their way to do the same.

Perhaps, I may be allowed to mention that we are asked frequently for advise as regards methods of planting, seed rates, etc., and this is also a direction in which we are glad to be able to assist in making known the teachings of the Agricultural Department.

V.—IMPLEMENTS.

COMMITTEE ON IMPLEMENTS.

DECEMBER 15TH, 1914—3 TO 5 P.M.

Present:

The Hon'ble Mr LL. E. BUCKLEY, I.C.S., *Chairman*.

1. Mr. F. G. Warbrook, Messrs. Massey & Co., Madras.
2. Mr. S. E. Sewell, Messrs. Best & Co., Madras.
3. Mr. B. N. Sawmi, Messrs. Burn & Co., Madras.
4. Mr. E. J. Warner, The General Electric Company, Ld.
5. Mr. Blake, Messrs. Oakes & Co., Madras.
6. M.R.Ry. Diwan Bahadur M. Audinarayana Ayya Garu, Madras.
7. M.R.Ry. N. Pattabhi Rama Rao Garu, Madras.
8. M.R.Ry. C. Arunachala Mudaliyar Avargal, Zamindar of Chunampet, Chingleput.
9. M.R.Ry. Raja P. Ramakrishna Rayaningar, Zamindar of Vittalapuram.
10. M.R.Ry. G. Jogi Razu Garu, Messrs. T. R. Tawker & Sons, Madras.
11. M.R.Ry. Vittaldas Sait Avargal, Tiruppur.
12. M.R.Ry. M. Gangarazu Pantulu Garu, Ganjām district.
13. M.R.Ry. Narayanamurthi Garu, Personal Assistant to the Director of Industries.
14. Mr. A. Chatterton, C.I.E., Director of Industries and Commerce, Mysore.
15. Mr. K. T. B. Tressler, Director of Industries, Madras.
16. Mr. D. T. Chadwick, Director of Agriculture, Madras.
17. Mr. R. C. Wood, Principal, Agricultural College, Coimbatore.
18. Mr. H. C. Sampson, Deputy Director of Agriculture, Southern Division.
19. Mr. G. R. Hilson, Deputy Director of Agriculture, Northern Division.
20. Mr. G. D. Mehta, Deputy Director of Agriculture, Central Division.
21. Mr. R. Thomas, Probationary Director of Agriculture.

AGENDA.

A.—Implements for Cultivation.

I. Is it possible to ensure that much better stocks of implements of different kinds are maintained in the Presidency Town or in other centres?

II. Can the firms and department arrange for trials of implements under different conditions and in different places and, if so, on what terms?

III. How can the firms and the department co-operate towards the adoption of better implements, *e.g.*, by—

(*a*) exchange of experience of the effect of implements;
(*b*) intimating areas in which there appear to be openings for certain implements;
(*c*) the establishment of pioneer depots up-country and stocking of spare parts;
(*d*) credit sales through depots at suitable Government farms;
(*e*) the maintenance at Government farms, with full particulars, of a stock of implements likely to be of use in that locality.

IV. Any other suggestions and criticisms.

B.—Implements for preparing produce for market.

I. Are the stocks of machinery now held in the Presidency Town adequate?

II. Can firms and the Departments of Agriculture and Industries arrange for the trial of machines under different conditions and in different places; if so, on what terms?

III. How can the firms and departments co-operate towards the adoption of better machines, *e.g.*,

(*a*) Exchange of experience of the effect of machines.
(*b*) By stocking spare parts.
(*c*) By a system of hire purchase.

IV. Can more information be provided for openings for such implements, *e.g.*, rice hullers, bone crushers, decorticators, oil presses, etc.

V. Can more facilities be given for—

(*a*) testing these;
(*b*) advertising them by actually showing them running in suitable villages.

VI. Any other suggestions and criticisms.

NOTES ON IMPLEMENTS.

A.—Implements for Cultivation.

Considerable advance has been made in Northern India in the introduction of improved implements of cultivation. Madras has not, however, to any appreciable extent, participated in this. The reasons for this are—

(1) The very varying agricultural conditions of soil and climate.

(2) The cheapness of labour and draught power.

(3) The small size and scattered nature of holdings.

2. *The very varying agricultural conditions of soil and climate.*—This is a factor which in Madras is much more present than it is in the North of India where, especially on the Gangetic plain, large tracts of country show little variation and where the type of improved implements introduced will, if suitable in one place, be suitable everywhere. The varying conditions of Madras are well illustrated by the variations which exist in the shape and size of the indigenous country plough. These variations are largely governed by the soil, the work required to be done and the size and strength of the draught animals available. All these points have to be taken into consideration when recommending to a farmer an improved implement.

3. *The cheapness of labour and draught power.*—Until recently this factor militated considerably against the introduction of improved implements. There was little incentive to labour saving, and, given time, the country plough can do very efficient cultivation if the land is ploughed several times, while its initial cost is very little compared with cost of an iron or steel plough. It is too much to expect that a ryot who has never had to pay more than Rs. 2—3, or its grain value on the threshing floor, for a plough, will, without very careful consideration put down 5 or 10 or 20 times this amount for a new fangled implement which he does not rightly understand and which if it breaks he may have difficulty in repairing. Of recent years however conditions have very considerably altered. The price of cattle and the cost of feeding them has more than doubled and the price of efficient labour has markedly increased. Not only this but the general rise in price of agricultural produce has been a great incentive to get greater yields and the farmer is beginning to realise that increased efficiency and greater expedition in his preparatory cultivation, although it involves more capital, is going to pay him. Thus there is a real demand at present for

better implements. This year in Tinnevelly ryots were offering to pay Re. 1-8-0 an acre for the hire of a double furrow disc plough without cattle and drivers, *i.e.*, nearly the cost of a country plough for each acre ploughed. Thus though there is a demand it is one which requires careful development. It is no use, merely selling ploughs. The ploughs must suit the local conditions and must also suit the purse of the purchaser. It has taken the Agricultural department seven years to introduce into the Tinnevelly district indigenous implements for drill cultivation and it is only now that the demand for such implements, made and sold by the department, is greater than can be supplied.

4. *The small size and scattered nature of holdings.*—This practically means the smallness of the credit of the individual farmer. Though this factor is much in evidence in certain parts more especially in the irrigated tracts where cultivation is done by tenants, there are many well-to-do and substantial farmers in the country. So that this difficulty is rather a warning to those desirous of entering this trade, that careful local enquiry into the economic condition of the people is essential before trying to develop a trade in any particular tract.

5. The chief obstacle which is in the way to prevent farmers purchasing implements is that there are no local agencies. The farmer, when he has screwed himself up to the pitch of spending money on, say, an improved plough, very often will write to the officers of the Agricultural department or will approach the managers of the Government Agricultural Stations and state his wants. After due enquiry into his local conditions he is recommended a certain type of plough and is informed that he can get these from the agents in Madras or Calcutta or possibly elsewhere and here the matter usually ends. The ryot's enthusiasm subsides. He is afraid of all the extra charges, such as railway freight, wharfage, etc., and unless the implement is sent down ready to use, knows that he will not be able to put it together and knows that without again writing to the agents he will not be able to get spares when parts break or wear out.

6. This leads up to the main heading on the agenda, viz., How can the firms and the department co-operate towards the adoption of better implements.

7. The Agricultural Department have of recent years tested many makes and types of implements and are in a position now to recommend a certain number for different classes of work, on different classes of land. They are also

in a position to point out defects in the design and construction of certain implements and to offer suggestions as to how these could be improved. The department also has now a considerable knowledge of the local conditions of the Presidency and, though this knowledge is not by any means complete, are able to indicate areas where there is scope for the introduction of certain classes of implements. The question of opening pioneer depots in the districts and of stocking of spare parts is a matter which deserves serious consideration.

8. It does not appear essential that such depots should hold stocks of implements provided stocks are held at the head-quarters of the agency or at suitable centres and are available there when indents are made on them: all that seems necessary is to have an agency where farmers can book orders. It is essential, however, that implements for trial should be kept in stock, at any rate for the present until these are better known in the district, as it is evident that the farmer wants to know what he is buying. It is essential also that the agent should know what he is selling, should know how to erect implements and should be able to demonstrate the implement in use. Possibly he himself would not do this but there is no reason why one of his servants should not be trained to do so. It is always possible for such men to be trained on the Central Agricultural Station at Coimbatore. It is essential, however, that such agents should stock spare parts, the quantity they stock depending on their sales. It may ultimately be necessary for such agents to have sub-agencies in larger villages for the stocking of spares. It is quite possible that such agencies may not in the first instance pay and the forcing of sales must be guarded against as this work needs careful handling and care to see that only the right class of implement is sold. The question then arises whether the firms are prepared to take the risks of these agencies or whether they would want support in the first instance by Government. It is quite possible that in the near future sales could be considerably assisted by district agricultural officers.

9. Another alternative is the location of depots under departmental control on the Government Agricultural Stations. Such depots have been tried on tow agricultural stations. The objections to these are (1) that the depot cannot always be located in the place where sales are likely to be greatest, (2) the agency is under dual control and there isthe probability of the firm concerned leaving too much to

the department and not taking sufficient interest in the agency themselves, (3) it does not seem desirable on general grounds for Government to appear as an agent for a firm.

10. The suggestion that each Government Agricultural Station should have a "sample room" of implements is not a new one and already one such exists on the Central Farm at Coimbatore. Unless however these implements are available locally the main obstacle still remains.

11. The question of the trial of implements for firms by the department on its Agricultural Stations is already a fact. Messrs. Ransomes Sims and Jeffries, who have spared no pains to adapt their manufactures to Indian conditions and who have, on two occasions at least, sent their expert representative to India with trial implements, have not only tested these on Government Agricultural Stations but have supplied implements for further trial and the department will always welcome any proposals for similar co-operation.

12. The following is a list of implements of cultivation which have been tested by the department and which they are prepared to recommend.

The Meston Plough made by Messrs. Burn & Co., Madras.—

Price Rs. 3-12-0, iron parts only.
,, Rs. 5, complete.

This is a one-handled plough, suitable for light cattle, for ploughing on light land. New shares can be brought for As. 4 each. This plough is not recommended for stony soils or garden lands.

The Monsoon Plough sold by Messrs. Octavius Steel & Co., Calcutta.—

Price Rs. 12, iron parts only.
,, Rs. 17, complete.

This is a one-handled plough, suitable for one pair of strong bullocks. It will do good work on all dry or garden lands except black soils. Only the point needs to be replaced and not the whole share, except at long intervals. The share is on the left-hand side so that the ploughman guides the plough with his left-hand and drives his bullocks with the right-hand. New points can be obtained for As. 3 and new shares for As. 10.

The Raja Plough sold by Messrs. Volkart & Co., Madras.—This is a two-handled plough which does good work on all classes of soil except black soil or wet lands. It is made with a short beam and is supplied with a wheel to regulate the

depth. More work can be done in a day than with either of the former. It can be drawn by one pair of big cattle—

Price, Rs. 30.

The Punjab Plough (Messrs. Octavius Steel & Co., Calcutta).—This is very similar to the previous plough, but like the "Monsoon" plough it has a renewable point like a chisel. The price of the new points is only As. 4 each, so that the cost of the wear and tear is much reduced. It can be drawn by one pair of big cattle—

Price, Rs. 25.
Cost of spare point, As. 4.
,, of share, As. 8.

The Steel-bar Plough (Messrs. Octavius Steel & Co., Calcutta).—This is a moderately heavy type of plough which is strongly made and is capable of doing ploughing on hard land. It is made of steel throughout, and the wearing point consists of an adjustable steel-bar, similar to the point of the country plough. It can be pulled by two pairs of medium sized, strong bullocks. By ploughing land after harvest with this plough immediate advantage can be taken of sowing rains—

Price, Rs. 45.
,, of spare steel-bar, Rs. 3–8–0.
,, spare share, Rs. 2–8–0.

The S.A.E. (Steel Eagle) Plough (Messrs. Octavius Steel & Co., Calcutta).—This is especially strong to stand heavy work. It is easy to guide, as the depth and width of the furrow can be regulated by means of two wheels fastened in front. It is suitable for breaking up hard lands and for doing deep work. Two to three pairs of strong cattle are needed according to the hardness of the soil—

Price, Rs. 75, complete.
Spare, shares, Re. 1 each.

The One-way Plough E.T. (Messrs. Octavius Steel & Co., Calcutta).—This plough is provided with an adjustable shaft pole, and is a combination of plough, ridge plough and cultivator. A useful general purpose plough which is strongly built, and which can be used to advantage on garden lands as it leaves no ridges or open furrows. The ridging attachment is useful for laying out ridges for irrigating crops such as sugarcane and ragi. It can be drawn by one pair of good cattle—

Price, Rs. 35.
Extra for hoeing parts, Rs. 7–8–0.
,, ridge parts, Rs. 12.

The "Planet Junior" Bullock hoe (Messrs. Oakes & Co., Madras).—This implement is supplied with several detachable tines and shares, so that it can be used instead of the country plough on ploughed land, or as a ridging plough, or to intercultivate between the rows of growing crops, where the width can be accurately adjusted—

Price, Rs. 35, complete.

Black cotton soil plough (Massey & Co., Madras).—This plough is specially useful for breaking up black cotton soil in the dry weather. The work is very thorough and may require up to six pairs of ordinary cattle. It is made in two sizes and costs—

No. 1, Rs. 55.
No. 2, Rs. 70.
Spare shares, Rs. 3-8-0.

The Defiance Disc Plough (Octavius Steel & Co., Calcutta).—In this plough the shares are replaced by cutting discs which render the draught very light. It is suitable for all deep soils (except very strong soils) whether moist or dry and does excellent work as it leaves a crumbled furrow. It ploughs two wide furrows at once and can be pulled easily by four pairs of good cattle—

Price, Rs. 194.
,, new discs, Rs. 12 each.

The Triangular Harrow.—Apply Principal, Agricultural College, Coimbatore, Lawley Road Post. This Harrow can be used for preparing the land for sowing, for covering seed or for intercultivation in a broadcasted crop. One pair of ordinary cattle can pull it easily—

Price, Rs. 7.

B.—Implements for Preparing Produce for Market.

13. Most of such implements are specialised, *i.e.*, are not of general utility. The most general of these are possibly those adapted for dressing grain and grading it for market, such as winnowing machines. The former is a farmer's implement but there seems little scope for this under the conditions under which grain is sold at present, *i.e.*, the increased price does not pay for the trouble of cleaning and grading.

14. The only other farmer's machine is the iron sugarcane mill. But since now this is universally in use, there seems little use in discussing it.

15. All other implements are either suited for co-operative purchase or for purchase by persons of substance such as big landholders and capitalists. These implements include rice hullers, groundnut decorticators, cotton gins, oil mills, disintegrators, power cane mills, etc. With the advent of mechanical power for lifting water for irrigation the scope of such machinery has greatly increased.

16. On this subject the Director of Industries writes as follows :—

"There are at present a considerable number of implements or machines in use for the purpose of preparing produce for the market. Some of these are very widely employed: others only on a limited scale. The commonest machine is the rice huller of which, so far as my information goes, there are about 200 at work in the Presidency. There are also a considerable number of oil presses and the number of these is increasing. Decortication is also largely carried on, as well as cotton ginning and baling. Most firms who supply these machines carry stocks and I do not think that the present arrangements can be materially improved upon."

17. As regards the testing of plant, application has been made in this department for the purchase of testing machinery. It is only by the use of such plants that definite information can be obtained regarding power, output and working. Of course, there is a good deal of practical evidence on this point to be obtained, but it is not of very much value as the personal equation enters in it so largely, and the evidence which is only second hand and given by illiterate persons, is frequently most unreliable. The proposed test plant by furnishing definite information regarding the performance of different machines, will show in what directions the machinery can be improved.

18. In the matter of influencing ryots with a view of making them adopt improved methods of production, firms in their own interest, through the medium of their agents do what they can, and in general the service rendered is good. They do not however, in general, interchange information with the Department of Industries, because they see no advantage in so doing, and what is more, are liable in certain cases to lose orders. In several parts of Tanjore, for instance, it is the opinion of this department, that the number of hullers established is at least equal to, if not in excess of, the supply of raw material and any applicants for advice are warned against trying to instal further machinery. From the point of view of the manufacturer the potential losses of

the purchaser are of no moment so long as the plant is paid for; and therefore in cases of this kind the interest of the Department of Industries representing the ryot and that of the machinery sellers are apt to come into conflict. *Per contra* the department is rather chary of passing on information regarding openings for machinery to firms, unless they reciprocate, for fear that this interchange will lead to the subsequent development of a district beyond its resources. This has happened in two districts already.

19. The difficulties connected with the introduction of machinery for the treatment of produce are the twofold character : (1) to persuade ryots to introduce machinery at all and (2) afterwards to prevent ryots and machinery agents from overdoing things. The only way in which the use of this class of machinery can be satisfactorily developed is by all enquiries passing through a Consulting Engineer. If this is done, the firms may lose slightly on the machinery which they might have installed to the detriment of the purchaser but for the intervention of the Consulting Engineer, but they gain very much more by being put in touch with all enquiries. At present, the Department of Industries represents practically the only Consulting Engineering organisation in this Presidency, and unless the necessity for the intervention of a Consulting Engineer in all matters connected with the installation of machinery is recognised, a complete exchange of experience between the department and the firms is impossible.

20. The Department of Industries has at present a staff of 12 supervisors and 24 mechanics, who are believed competent to obtain all information possible regarding openings for machinery.

21. As has been explained testing machinery has been applied for, and it is the policy of the Department of Industries also to demonstrate the use of machinery where necessary by actual running. This has been done in the case of sugar crushing and will shortly be undertaken in connection with power ploughing. But the shortage of funds generally prevents this system of advertisement being developed very much.

SUMMARY OF THE DISCUSSION ON IMPLEMENTS.

Mr. Chadwick opened the discussion by saying that he did not think that the openings which existed up-country for

the sale of better implements had been fully realised by firms in Madras. The price of cattle had risen and was rising. The Agricultural Department, eight years ago, had been inclined to leave ploughs and implements alone on account of the unfortunate experiences they had had with such implements in the past; but latterly the rise in the price of cattle and the enquiries which were being received from ryots all had drawn their attention once more to ploughs. But there are no agencies up-country from whom spares can be obtained and the department themselves at times have had great difficulties in obtaining spares or even ploughs in Madras.

In reply to Mr. Sewell's surmise that the supply of spares would soon adjust itself to the demand when that appeared; the point was that a ryot saw a plough at work and wanted it immediately; that enthusiasm was apt to wane if there was any delay in supplying from Madras. It was sufficiently bad to have to wait to write to Madras. The officers of the Agricultural Department believed that there was a fairly large opening up-country for a plough like the monsoon one; but so far as they knew no one has ever gone up-country to endeavour to push these, or demonstrate their value, or in fact to spread sales in any way. It was of no use to appoint as local agent a man who knew nothing about ploughing and would sell the same plough, for any purpose. More damage than good would be done by such action and the use of implements might thus be greatly postponed.

Mr. Chatterton vigorously criticised the policy of describing several ploughs as had been done in the note submitted to the conference and took up the position that the Agricultural Department ought so to speak to standardize the plough that was required, enter into terms with some local manufacturers to make them and to work with that firm alone in pushing that plough and practically only that plough. In the earlier stages of introducing machinery there was insufficient trade to allow six or a dozen competing firms to maintain proper stocks and supply of spares, whereas if all be diverted to one firm there is sufficient business to ensure the maintenance of these supplies and the consequent expansion of trade. To this, answer was returned that for the diverse agricultural conditions of Madras it was impossible to prescribe only one kind of plough. The Agricultural Department were not at present prepared to recommend any iron plough for ordinary wet paddy land, and the plough they would advise for use on the red loams of Coimbatore would be very different from that suited to the black cotton soil of the Ceded Districts. Mr. Hilson said that it would be possible to name four or five

ploughs one of which would prove suitable to any given condition in which the purchase of a plough was recommended. Rev. S. D. Bawden objected to all the ploughs on the list in that they were compromises between the American and Indian plough. Mr. Wood would not accept this description as certainly some of these designs were the results of work done by experts sent expressly by some of the best known firms in England which deal in Agricultural implements to study Indian conditions. Other members present who knew Northern Indian conditions supported Mr. Chadwick in saying that Agricultural conditions were much more diverse in Madras and that it was impossible to prescribe one plough for all parts of this Presidency.

Mr. Warbrook enquired whether leaving out of account the large black cotton soil plough the department could say for which of the ploughs named they anticipated the largest demand at present. It was immediately replied that the monsoon plough satisfies the conditions more nearly than any other and that there was considerable opening for it on garden and red soil. Mr. Velliangiri Gounder said that he was using the monsoon plough and found it efficient and satisfactory. One ploughing with it was equal to three ploughings with the ordinary country plough and it was useful on both dry and garden lands. Mr. Audinarayana Reddi of Alur corroborated him in saying that this plough was the best iron plough that he knew of. It could plough $\frac{1}{2}$ to $\frac{3}{4}$ acre of land a day with medium sized bullocks. The Zamindar of Chunampet, Chingleput District, also agreed with this from his own experience. On this Mr. Chatterton reopened the question of local manufacture and Mr. Chadwick agreed that with a properly managed local manufacture, the supply of spare parts would doubtless be sure, and it was probable that they would take more vigorous action in pushing sales in the country than agents. But the immediate point, from the point of view of the Agricultural Department was to endeavour to meet this growing demand up-country for new ploughs by getting into the hands of the ryots that implement which seems to be best suited for their conditions and purposes and the department were not in a position to say whether any local firm could make similar ploughs—say, for instance, the monsoon plough—at anything like that price. In answer to question by Mr. Buckley, Mr. Chatterton thought they could be made locally as cheaply as they could be imported. The chief expense in manufacture was the setting up of the machinery for chilling the surface. Neither Mr. Warbrook nor Mr. Blake was able to estimate

offhand the minimum sales which would be necessary to render it worth while for local works to start such manufacture.

The question of trials of agricultural implements was next taken up. Mr. Chadwick said that they had carried out many trials at the request of several firms. In reply to question by Mr. Buckley he did not consider that fairs or shows formed good places for conducting trials or tests of ploughs. As Mr. Wood said, one of the most important things was the wearing capacity of the plough and it ought to be tried on different lands and in different conditions. For this reason private trials had hitherto been usually conducted, but both Messrs. Warbrook and Blake stated they would prefer public trials in which representatives of firms should be present. The department stated that they were willing to do so and will endeavour to arrange such trials in future. One member suggested that the firms should send down their representatives to attend shows and give demonstrations then. Although something can be done at such times yet Mr. Wood said experience had shown that greater results follow from travelling from village to village holding demonstrations in the course of the tour. Mr. Chatterton suggested that on such tours it would be well if an agent of the firm accompanied the Agricultural Inspector. Mr. Warbrook and Mr. Blake besides some of the other firms said that they thought their Principals would be quite prepared to agree to send representatives on such tours. This would be an advantage as at present considerable delay is caused in getting and booking an order and if a representative of the firm were also present at the time of demonstration he will be able to hear the criticisms of the ryots and also to book immediately any orders they might give. This course was considered preferable to starting pioneer depots up-country which scheme did not commend itself thoroughly to the delegates. They however were prepared to support the maintenance at Government farms for exhibition purposes with full particulars stocks of implements likely to be of use in that locality. Mr. Bawden and Mr. Chatterton had some discussion over the feasibility of establishing schools where children could become familiarised with new machinery and tools.

Mr. Buckley hereon enquired whether what had been said with reference to ploughs covered other agricultural machinery or it would be necessary to go over the same lines with each implement. Mr. Warbrook replied that detailed discussion was not necessary as generally speaking the manufacture of other agricultural implements did not as a rule call for so much special capital as that of ploughs.

Mr. Chadwick informed the meeting that representations had been made to him that the railways should carry agricultural implements at railway risk unpacked and wished to know whether any of the firms wanted to say anything thereon. Mr. Wathen replied that this subject was coming up before the goods classification committee at the next Railway Conference and read out some extracts from their reports which seemed to indicate that the desires of the firms in this matter might possibly be partially met. He said that spanners and such like small articles attached to ploughs ought always to be packed as parcels and not as goods. He could not guarantee their delivery.

Mr. Ramarayaningar enquired whether motor ploughs were successfully working in Madras, as he heard that they had been in Gwalior to do 7 acres a day 16 inches deep. The answer was given that these ploughs were only used in very special localities for very special purposes and Mr. Chadwick did not recommend their general use at present in Madras Presidency. Messrs Parry & Co. had been using steam machinery for cultivating land at Nellikuppam but they were there cultivating a large area with an expensive crop, namely, sugarcane and they had their factory shops close at hand ready for repairs. The two furrow disc ploughs costing about Rs. 200 would probably meet most of the requirements of any ryots in the black cotton soils in this Presidency. They could be drawn by three pairs of bullocks.

Discussion then turned to the consideration of implements for preparing produce for markets. Mr. Chatterton complained that it usually takes three months or longer to get any machine not kept in stock in the country and that owing to the variety of machines offered by makers there was not a sufficiently steady demand for any one of them to ensure maintenance of a proper stock. Mr. Vital Das Sait informed the meeting that there had been a very heavy increase in the number of oil engines and the machinery in Coimbatore district, but this development has received a serious check as the firms and the department has ceased to sell machinery on the hire purchase system. In that district alone there were 170 oil engines and 53 pumping engines. Mr. Warbrook explained that they had found it necessary to exercise ever increasing care in working these hire purchase sales because they found it so exceedingly expensive to recover later instalments. Mr. Chatterton was then asked to explain the system which is in force in Mysore under which Government loans are given for the purchase of machinery. The length of the term of repayment is fixed according to the nature of the machine

purchased. The Department of Industries gives the ryot an estimate of cost, etc., and of that a quarter is to be paid down. The department purchases the plant outright from the firms erects it and hands it over to the ryots. The balance of the purchase money is then recovered from the ryot together with interest at six quarter per cent. during the next three or five years just as if it were land revenue. The system works smoothly. Last year Rs. 44,000 worth of machinery were sold. The ryots prefer this as all the difficulties of getting loans and the consequent revenue enquiries are avoided. It is necessary that the ryot should not be left the freedom of choosing his own machinery. If any Government system of advance were introduced, the Government must retain in its own hands the right to select the machinery to be used.

Mr. Adinarayana Reddi then asked that he should be supplied information about winnowing machine for paddy, the cost, outturn, etc., and Mr. Chadwick promised it should be done.

Mr. Chatterton then made an important suggestion. He said that considerable amount of work of an industrial character was now being done in different provinces in India and it was very difficult to obtain current records of the work in progress and he suggested that a series of departmental bulletins might be issued by some officer attached to the Government of India somewhat after the nature of the scientific bulletins issued by Pusa. He would collect most of the work done in the various provinces and presidencies and publish it; or it might take the form of an All-India magazine devoted to both Agricultural and Industrial matters. This suggestion was noted.

VI.—WELL IRRIGATION BY POWER.

COMMITTEE ON WELL IRRIGATION BY POWER.

DECEMBER 16TH, 1914—11 A.M. TO 2 P.M.

Present.

The Hon'ble Mr. Ll. E. BUCKLEY, I.C.S., *Chairman.* (Till 12 noon.)

1. M.R.Ry. G. Jogi Razu Garu, Messrs. T. R. Tawker and Sons, Madras.
2. Mr. F. G. Warbrook, Messrs. Massey and Co., Madras.
3. Mr. Blake, Messrs. Oakes and Co , Madras.
4. Mr. S. E. Sewell, Messrs. Best and Co., Madras.
5. Rev. A. Andrew, Chingleput.
6. Rev. S.D. Bawden, American Baptist Telugu Mission, Kavali, Nellore district.
7. M.R.Ry. C. Seshagiri Rao Garu, Kottapalli, Gōdāvari District.
8. M.R.Ry. C. A. Venkatakrishna Ayyar Avargal, Coimbatore.
9. M.R.Ry. Raja P. Ramakrishna Rayaningar, Zamindar of Vittalapuram.
10. M.R.Ry. Raja Panugunti Venkataranga Rayaningar, Zamindar of Kallur.
11. M.R.Ry. V. C. Vellangiri Gounder Avargal, Coimbatore.
12. M.R.Ry. R. Sivarama Ayyar Avargal, Tinnevelly.
13. M.R.Ry. Rao Sahib M. Abraham Pandithar, Tanjore.
14. M.R.Ry. K. Adinarayana Reddi Garu, Vellore district.
15. M.R.Ry. J. Narayanamurti Garu, Personal Assistant to the Director of Industries.
16. Mr. A. Chatterton, C.I.E., Director of Industries and Commerce, Mysore.
17. Mr. K. T. B. Tressler, Director of Industries, Madras.
18. Mr. D. T. Chadwick, Director of Agriculture, Madras. (*From 12 noon*).
19. Mr. R. C. Wood, Principal, Agricultural College, Coimbatore.

20. Mr. H. C. Sampson, Deputy Director of Agriculture, Southern division.
21. Mr. G. D. Mehta, Deputy Director of Agriculture, Central division.

AGENDA.

I. Selection of engines and pumps, and well boring apparatus.

II. Difficulties experienced in supervision, erection, carrying out of repairs and inspection.

III. Loans for the purchase of such implements.

IV. From experience the limits at which the establishment of power plant for lift irrigation is unprofitable.

V. Can any steps be taken to improve the supply of trained drivers and where is there a demand for them ?

VI. Are difficulties experienced in getting spare parts and how can those be removed, *e.g.*, by more local stocks, etc. ?

VII. To what subsidiary purposes can such engines be put in the off season ?

VIII. Can the Departments of Industries and Agriculture be of more assistance—

(*a*) to enquirers,

(*b*) to firms,

in regard to supplying information about the openings, possibilities and defects of such engines ?

IX. Are more trials needed and can they be arranged and, if so, how ?

NOTE ON POWER IRRIGATION.

The installation of power for lifting water involves several considerations other than the quantity of water available. The contour of the land is a point which should always be considered : for it may often happen that a well can supply a much larger volume of water than can be economically utilised. Again, the question of the type of farming which is to be followed should always be borne in mind, as the duty of water for different crops varies very considerably. This again involves the question of rotations, fallows, etc., and it may be necessary, in order to make the installation of power lift pay, to alter the class of farming so as to utilise to the maximum the available supply of water without letting the plant lie idle.

2. The introduction of power water lifts involves also the question of manure supply. If machinery replaces bullock power, the farmer at once loses a certain supply of cattle manure which is of such great value in maintaining the mechanical texture of the soil. Moreover power irrigation usually means an expansion in the area commanded by the well and also a more intensive system of farming ; thus this question is intimately connected with the manure supply and besides opening up a field for the extension of concentrated manures also suggests the value of green manuring for this class of farming.

3. These points are mentioned as indicating the desirability of local enquiry before suggesting any particular size of plant; as naturally much loss of business follows, if plants are installed which are not suited to requirements and which are worked at an excessive cost.

4. On the subject of power irrigation the Director of Industries writes as follows :—

So far as the information available in this Department goes there are about 600 oil-engines now at work for irrigation purposes. The engines used are almost exclusively of the internal combustion type, *i.e.*, oil and gas engines. The class of engine employed depends mainly on the enterprise of the agents. Several types of engines are at present in the Madras Market, most of which can be regarded as good and it is not a matter of great importance which particular make ryots select, but the important thing is the way he is treated by the agent. Some firms, for instance, possess an engineering staff and workshop and are able not only to sell the engine but also to erect it and to supply all accessories and fittings. If they are firms of standing, they will meet the ryot in a reasonable way in cases of dispute regarding spare parts, breakage, etc. ; and it is to these things and rightly, that the ryot attaches the greatest attention ; and it is the firms who take some trouble to satisfy their customers that get the orders.

Lift irrigation is, in most cases, effected by pumping water from a well. Underground supplies of water in South India are small as compared with other countries such as Egypt. In Egypt it is not an uncommon thing to be able to use a 8 or 9-inch pump on a well: in India the supply in a well is only rarely in excess of that which a 4-inch pump can deal with and in a large proportion of cases does not even exceed the capacity of a 3-inch pump. It is not strictly correct to define quantities in terms of pump diameter, but the latter

is a simple way of stating discharges and may be retained for purposes of general argument. A 4-inch pump yields rather more than 300 gallons a minute or about $\frac{3}{4}$ cusec and a 3-inch rather less than 200 or about $\frac{1}{2}$ cusec.

The selection of an engine and pump lies not in determining the maker of the plant, but in determining the maximum size of pump that a well can supply and the horse-power that is required to lift this amount of water through the distance required to enable it to irrigate by gravitation. This point can only be determined by a local enquiry, which the Department of Industries is prepared to conduct on payment of Rs. 10. An enquiry of this kind is most important, because conditions in wells always vary and it not infrequently happens that a ryot, if he uses his own discretion, puts in a pump which is much too big for the well. Such a pump requires a larger engine to work than a small one, and the capital cost of the installation is therefore excessive ; whilst, on the other hand, an excessive drain on a well yields a smaller total quantity of water than normal draught. The discharge is of course greater in the first case, but the well is exhausted so quickly that it takes more than a proportionately longer time to recover as compared with the smaller pump.

The usual sizes of engine for a 3-inch pump are $6\frac{1}{2}$—9 h.p. for a 4-inch $7\frac{1}{2}$—12 h.p.

(1) When an engine and pump have been purchased the Department of Industries undertakes to erect it for a charge equivalent to $2\frac{1}{2}$ per cent. on the capital cost. If the supplying agents are prepared to undertake erection, the department does not interfere. In many cases firms do not erect and in that case the choice lies between departmental erection and the local fitter. Local fitter's charges are usually low, and are in many cases preferred with the most disastrous results. The erection of an engine, like everything else, requires a certain amount of intelligence and such intelligence the locally trained fitters do not always possess. Moreover, their system of charge is a variable one. The initial fee is low, but there are always " extras " during the course of the work and it not infrequently happens that the fitter finally appropriates the spare brasses on leaving the work.

One of the great difficulties the department has to contend against is the inability of the average ryot to understand that it is infinitely cheaper in the long run to get his machinery properly erected to begin with than to leave it to a local amateur.

(2) When a plant has been erected the Department of Industries undertakes to inspect it periodically and maintain it in a working condition for the sum of Rs. 15 a year. But this fee also some machinery owners regard as excessive.

(3) Agricultural loans are granted for the purchase of machinery and several agents are also prepared to sell their plant on a hire purchase system.

(4) Hitherto it has been supposed that the minor limit for profitable lift irrigation has been the 3-inch pump, but certain new and very cheap engines have recently been placed on the market and it seems possible that this limit may therefore be reduced in the near future. If this is possible the field for lift irrigation will be greatly extended.

The development of the use of machinery has led to an increased demand for trained drivers. It is usually desirable that an owner should train himself or one of his relations to run the engine, and facilities can be arranged by the Department of Industries for acquiring such necessary experience. There is also a class for Oil Engine drivers held in one of the Madras Industrial Schools. The difficulty about all instruction of this kind is to make the individuals recognise their limitations. Just as a motor-car driver should be prevented from meddling with his machinery so should an oil-engine driver confine his activities merely to driving his machine, and should call in expert assistance when the machine goes wrong. This is what drivers do not understand. They learn a little bit about oil-engines, and on the strength of such knowledge they proceed to meddle with the parts, interference generally leading to breakdown. In the Department of Industries there is also a labour register maintained, and individuals requiring drivers can apply to the Bureau of Industrial Information.

Spare parts are stocked by most firms and with the better ones no difficulty is experienced in obtaining replacements. If, however, ryots purchase their engines from people who are merely agents and not also engineers they cannot expect to obtain spares whenever they want them.

Oil-engines used for irrigation are only run for a part of the year, and in the hot season are very largely employed for other purposes such as oil-milling, cane-crushing, decorticating, etc.

The area that an oil-engine can irrigate depends chiefly on the manner in which the water is utilised. In irrigation engineering the duty of water is defined as the area which one cubic foot per second of flow (one cusec) can irrigate. Pumps are usually run, or should be run about ten hours a day, so

that the duty of the discharge from a pump may be regarded as 40 per cent. of the duty of the equivalent constant flow.

The duty of water varies very greatly. In one large irrigation scheme it has reached as high a figure as 120 (acres); in the Divi project it was estimated at about 100. In the Delta tracts it is from 50 to 70.

On the above figures, therefore a 4″ pump yielding half a cusec should be capable of irrigating about 24 acres and a 3″ pump about ten. The duty is calculated on paddy crop and should be higher for crops requiring less water. I have been trying to obtain figures of duty for small pumps for some time, but the data I have obtained are not sufficiently definite to publish before a critical committee of agriculturists. Mr. Chatterton conducted some tests several years ago and the areas irrigated substantially agreed with the figures above given. In one case a 4″ pump irrigated 20 acres of paddy and about 6 or 7 acres of other produce, in another it irrigated 15 acres of groundnut, 5 acres of gingelly and 3 acres of paddy. A 3″ pump irrigated 20 acres of land formerly dry. Now that oil-engines are becoming more popular there is a tendency on the part of the owners to waste water and to use them to less than their full capacity. Lift irrigation by power is naturally expensive and unless water is economically used and the plant run for a sufficiently long period annually it will not pay. In the few cases where ryots are dissatisfied with the value of the lift irrigation the reason is usually to be found in one or two cases above mentioned.

SUMMARY OF THE DISCUSSION ON WELL IRRIGATION BY POWER.

At the suggestion of Mr. Buckley the question of loans for the purchase of machinery and implements was first discussed. He said that from what he had heard the system recently adopted in Mysore differed from that followed in Madras and he would like to hear more about it. In this Presidency loans are granted for the purchase of irrigational machinery and not of industrial machines. Mr. Tressler said that a better system was for the Department of Industries to purchase the plant outright for the ryot, erect it and recover the total cost with interest, etc., as an arrear of land revenue. In fact a modification of the hire purchase system. One member interposing asked if grants were still to take the form of loans why should not they be given by the Agricultural or Industrial Departments; there were so many delays and

formalities now that full use of the facilities offered was not made. Mr. Buckley said that whatever system was adopted the responsibility of the officer who granted the loan must be clear. Collectors are now responsible for seeing that the security offered is sufficient and that the grant is both advisable and safe. If this responsibility was to remain with them it was impossible to expect them to give loans merely on the recommendation of another department without satisfying themselves as to the security. If it was clear that the other department was responsible for the sufficiency of the surety and for any bad debts which might arise he thought that the Revenue Department could assist them in acting merely as a collecting agency on their behalf. But they could not forego the necessity for their own investigation if they had to retain the responsibility for seeing that the loan was good. Mr. Chatterton urged that the other system had caused no difficulties whatever in Mysore. The Revenue Department executed the demand issued by him over his signature and presumably he was responsible if a loan were given to a worthless applicant. Instalments were collected as an arrear of land revenue. The term of repayment depended on the class of machinery for which the loan was granted. Thus for agricultural purposes the loan might run for seven years but for industrial machinery for not more than five years. Some of the members urged that the term of repayment should be in all cases twenty years, but it was pointed out that the term of repayment must always be well within the running life of the machinery. Mr. Chatterton said that to meet cases of delay it was well to include provisions for the levy of penal interest; and that the Director of Industries ought to have discretion to request that repayments of instalments be postponed in special cases for special reasons beyond the ryot's control. He emphasised a fundamental difference between agricultural and industrial loans, which was frequently overlooked when merely a loan was granted for machinery after enquiries by a department without much direct knowledge of industrial matters. The adoption of his hire purchase system checked this evil to a very large extent. In agricultural loans the only points at issue were the suitability of the land and the supply of water. If these were satisfactory and the security good the grant of the loan was to the general benefit of all as it increased the total productivity of the earth. In industrial undertakings however, it is necessary to see that a ryot who instals such machinery with Government assistance does not become subjected very shortly afterwards to undue competition by

the erection of a similar plant in the near neighbourhood by another ryot again with the aid of a Government loan. If the second ryot does so entirely at his own cost and venture there is nothing to be done; but if the object of the Government is to develop local industries and resources by the introduction of machinery suitable to the ryot it is ridiculous under a policy of encouraging loans to give rise to local competition on such a scale as to render the use of machinery unprofitable. There was a danger of some such result if the Industrial Department had not a say in the grant of such loans. The hire purchase system prevented this as the first point examined before giving a certificate was the extent of local competition. These remarks applied especially to such machinery as rice hullers, sugarcane plant, etc. One ryot erects a plant and makes a profit. One or two of his neighbours at once wish to copy his example in the same locality and the final result is loss for all three. Mr. Tressler observed that in parts of Tanjore in regard to rice hulling undue competition in certain localities had produced such results, and Mr. Buckley reminded the meeting that undoubtedly one of the chief reasons which had contributed to the pre-eminence of Java in the sugar world was the fact the factories could not be established without Government sanction and that Government took care not to allow a new one to be erected in such a position as to jeopardize the supply of cane to an existing factory. Of course it was impossible to prevent private mills from being erected in this country with private capital, but the point seemed to be that where the Government assisted in the erection of such machinery considerable discretion and control must be exercised to prevent unreasonable competition resulting from such assistance.

One of the objections raised to the application of the Takkavi Act was the publicity required under the rules; and Mr. Buckley remarked that a suggestion had been made to Government that a grant under the Loans Act might be placed at the disposal of co-operative societies to enable them to make advances for the sinking of wells; the society as a whole would be responsible for the loan. Mr. Tressler said that he could not undertake the responsibility for all these small wells and had made the suggestion to work through co-operative societies as he thought that perhaps thereby recovery might be facilitated. He was not however sure. This point was not however threshed out as Mr. Chatterton diverted attention by outlining another proposal that he had. That was the formation of co-operative societies on a limited liability basis to work improved plant, *e.g.*, his

large jaggery plant. Under that the ryots would bind themselves not to use country mills but bring all their cane to the central factory which would be owned by them. If they do so Government would give them a loan to instal the machinery on their joint security. In actual fact this is the principle of an industrial co-operative society, only in the first instance the loan is given by the Government. In the agricultural co-operative societies working in the cotton tract of Tinnevelly the members are bound to sow only pure karunganni cotton in their fields and to bring all their produce together for joint sale. Independent action on the part of members in any trading co-operative society (especially in the early stages) is very apt to ruin the society and dissipate all the advantages resulting from joint action.

Mr. Sivarama Ayyar enquired whether the Government could not instal small engines, etc., themselves and sell the water to the ryots at so much an acre. One great difficulty was that it needed about 20 acres to make the installation of power plant profitable and it was not always that a ryot had that extent in a compact block and he could rarely persuade his neighbours to combine with him. Mr. Chatterton answered that this system had been tried on the banks of the Ganjana river in the Cuddapah district, and had not been a success. Rs. 5 an acre had been charged for water. The Madras Government had also spent Rs. 20,000 in similar efforts when lift irrigation by engines and pumps was in the experimental stage and none of the earlier installations were finally successful. The point was that it was unduly expensive for the Government to manage these small scattered installations; in fact the ryot managing his own plant did it at half the cost what Government could do it for with hired labour. Moreover as soon as the ryot owned the engine and pump he took much greater pains to see that he utilised the water more economically and thoroughly. An instance had occurred in Mysore in which they had investigated a proposal for a pumping installation from a small river. The Government endeavoured to run it charging water-rate; but the ryots objected that the rates were absolutely prohibitive. Now 70 or 80 ryots have joined together and have taken it over and it is working profitably and successfully. Mr. Buckley said that Government could not possibly undertake to run such small concerns.

Mr. Chatterton then said that there were about 1,100 oil engines at work in this Presidency whereas there is scope for about 10,000 and one thing which checked advance was that the ryot was still prone to use too much water for his crops.

Mr. Sampson doubted this and certainly thought that this cry of wastefulness of water was often overdone in regard to garden crops; he could not accept any such sweeping statement. There undoubtedly appeared to be scope here for more interchange of experience and for closer work between the two departments; and Mr. Chatterton mentioned that in Bombay there was no separate and distinct Industrial Department.

Mr. Buckley asked whether anyone present had had any difficulty in getting a loan for such purposes. Mr. Anantakrishna Ayyar said he had no difficulty but there had been delay.

The question of fuel was important. The ryot was apt to get into difficulties in dealing with liquid fuel and at present Mr. Chatterton was inclined to favour charcoal burning engines wherever charcoal could be bought at Rs. 35 a ton or under. Attention was then turned to the consideration of the selection of engines and pumps and the connected questions of inspection and supervision. Mr. Chatterton again brought forward the principle which he had advocated on the committee on implements, viz., that in the earlier stages of introducing machinery up country it was essential that the department worked at most with one or two firms; that the ryot must be in a position to obtain spare parts by telegraphing for them and that if there were a dozen or more firms dealing in a dozen or more varieties of engines all equally pushed by the Department of Industries it was not possible for them all to carry a sufficient stock of spares. Finally there was as a rule a better chance of repairs being promptly attended to if the sellers of the engine had a foundry in Madras. Although it was not possible that every one present could accept this contention unreservedly yet all agreed that it was a prime importance alike to trade, to the ryot and the Department of Industries that such installations which were erected could be as suitable as possible for the needs and conditions of the ryots. Otherwise it only damaged trade and checked development. Mr. Tressler's assistant quoted a case in which a ryot had bought an engine which was entirely unsuited for the purpose required. Both Mr. Warbrook and Mr. Blake pointed out that the position in which the firms were did not seem to be thoroughly realised by the Department of Industries. A ryot frequently came to them in a great hurry for an engine, the season was unpropitious and he wished to save his crop. He had probably seen one of his neighbour's engines at work and asked for a similar one not knowing whether it was of the form and

power most suited for him. It was impossible for firms to keep a staff of men upcountry to investigate every such case and the firm either had to do the best it could for him or persuade him to go to the Department of Industries or to lose the order. Mr. Blake and Mr. Warbrook said that they were perfectly ready to work in with the Department of Industries if certain conditions could be observed and the disposal of references expedited. They had not detailed knowledge of irrigational matters upcountry and would welcome the assistance of the department. On being asked Mr. Chatterton readily acknowledged that the firms were much more friendly disposed to the efforts of the Department of Industries than was the case some six or eight years ago. So to give definiteness to the discussion Mr. Chadwick asked Mr. Warbrook whether he could formulate then and there his chief conditions. They were--

(1) That on reference being made by a firm or on a ryot being sent to the department by a firm the department if they could not approve of the engines, etc., sold by that firm at least would not place the order with some other firm. As if the department did so it was impossible to carry on business. Mr. Chatterton said that he had never done so and Mr. Tressler agreed. They would inform both the ryot and the firm why they disapproved of that type of machinery and leave it to either of them to make the next move.

(2) The next condition was that not infrequently great delay occurred in getting the opinion of the department during which the ryot became weary went to some less responsible agent and bought something out of hand. This was mainly a matter of adequate and competent staff. This was admitted, but it was most strongly urged that if the department undertook this class of work and enquiry (which admittedly was of the greatest importance) and expected the firms to refer their orders to them they must be in a position to cope with them promptly and without delay. There was a great need for a stronger and much better controlled district staff. The firms were glad of the proper sketches now supplied, though in some cases it seemed that they were a little too elaborate as it enabled them to deal with orders more promptly and completely. But delay only drove the ryot to less responsible agents, who possibly sold him an engine straight away and would then keep him waiting for months for the connecting pipes. The chief delay occurred at present in the local investigation.

(3) The next point was that the ryot should know where to find the Supervisor for his neighbourhood.

(4) The last point was that the levy of a preliminary investigational fee of Rs. 10 frequently prevented the ryot from coming for advice. Mr. Warbrook said that this had checked development but would not be a great obstacle if the ryot knew that applications were very promptly dealt with. On being asked he estimated the number of applications for oil engines in the busiest time of the year at about four or five a week.

The question of a sufficiently numerous competent staff upcountry also was mooted when difficulties connected with inspection were considered. Inspection was necessary, otherwise petty repairs were not attended to and the machinery became badly damaged. Mr. Anantakrishna Ayyar did not object to the annual fee of Rs. 15 for inspection but urged that if this were collected the engines ought to be inspected at least three times a year without fail and the results of inspection communicated both to the owner and to the Director which at present was not done. Mr. Sivarama Ayyar preferred a fee of Rs. 5 for each inspection, but endorsed the previous speaker's remarks about communicating the results of inspection. He cited a case close to his own village in which an engine was not running properly the Supervisor came, inspected it and went away and nothing happened. It was no answer to say that the ryot ought to have complained to the Director of Industries in Madras. He barely knew of his existence. Rev. M. Andrew went still further and advocated that the Government might well have the monopoly of the selection, erection and inspection of all engines for, say fifteen years, by which time if energetically pursued they would be sufficiently numerous to allow private enterprise to intervene. Mr. Andrew was very strongly of opinion from his own experience that many more trained men were required in the department upcountry for purposes of inspection and giving advice. He would not make it compulsory, but would make it so easy to obtain inspection and advice that most would readily avail themselves of it. He objected to this annual fee of Rs. 15 altogether; as also did Mr. Warbrook who feared that it deterred ryots from asking for inspection until great damage had been done to the engine. The Officers of the Department of Industries maintained that experience had shown that ryots did not value that for which no payment was made; that if no fee were charged supervisors might be summoned for no real reasons and that ryots would in practice be tempted to leave the care of the engine practically to the supervisor instead of attending to it properly. But Mr. Tressler agreed that with the hire purchase system

it might be possible to arrange to charge this fee in some form less troublesome to the ryot than the present one; and they agreed that their staff was inadequate but would do what they could to get it increased.

The question of the limits at which the establishment of power plants becomes profitable is an important one and caused some difference of opinion. Mr. Chatterton did not advise the use of anything less than a 3″ pump. The efficiency of a 2″ or $2\frac{1}{2}$″ pump was much less than that of a 3″ one. Petrol engines again were dangerous in the hands of inexperienced ryots. A three-inch pump running 12 hours a day gave sufficient water to irrigate 20 acres of sugarcane, plantains or turmeric or garden crops of all kinds on ordinary loamy soil. It should be able to lift 12,000 gallons an hour without reference to the depth of the well. From his own experience Mr. Sivarama Ayyar said he had not been able to bring 20 acres of sugarcane through the hot weather with a 3″ pump, and Mr. Wood agreeing with this said that accepting Mr. Chatterton's figures there was only sufficient water for 15 acres, since for a thorough watering in the hot weather 2 inches was required. Mr. Sivarama Ayyar thought that even this area was a little high. He had a 4″ pump which was at present only managing 18 acres though by improving his channels to check seepage he hoped to command another 18 acres. Mr. Chatterton still thought that with ordinary loam a 3″ pump should easily suffice for 15 acres of sugarcane, and added that the best way to manage an oil engine was to start it and then let it run. Mr. Bawden agreed with this and said it was the custom in America but many of the members present thought that this called for too much faith.

The opportunities for getting trained drivers are small. There exists Chengalvaraya Naicker's Institute and Mr. Tressler said he soon hoped to have more and better industrial training schools opened.

Many enquiries were often made as to what use oil engines could be put in the "off" season. Mr. Chatterton deprecated their being put to any subsidiary use other than for some purpose closely associated with the agriculture or local industry of the tract. Thus the engine could well be employed for crushing cane in a tract in which cane is being grown; but it was frequently the case that more powerful engines were required for machinery, *e.g.*, rice hulling than for merely pumping water. As a rule it was only in the rainy season that a pumping engine was not in constant use. Rice hullers required 14 h.p. engine.

Mr. Velliangiri Gounder asked whether the Department of Industries could not have more portable oil engines for demonstrational purposes, to which Mr. Tressler replied that he had nine regularly and fully employed. The landholders present however requested that more publicity should be given to these trials and that steps might be taken to advertise where they were and whence they could be obtained.

VII.—JUTE.

COMMITTEE ON JUTE.

DECEMBER 16TH, 1914—11 A.M. TO 12 NOON.

Present :

D. T. CHADWICK, Esq., M.A., I.C.S., *Chairman.*

1. Mr. I. Scott Mackenzie, The South Indian Industrials, Madras.
2. Mr. W. R. H. Wait " "
3. M.R.Ry. B. V. V. Narasimha Razu Garu, Bimlipatam.
4. Mr. G. R. Hilson, Deputy Director of Agriculture, Northern Division.
5. Mr. R. Thomas, Probationary Deputy Director of Agriculture.
6. Mr. W. H. Harrison, Government Agricultural Chemist.

AGENDA.

Whether efforts should once more be made with jute to ascertain what at present are the main defects in the present trade and see if any steps can be taken by the Agricultural Department to mitigate them.

NOTE ON JUTE.

Though the true jute (*Corchorus capsularis*) is not grown in this Presidency there are considerable areas of fibre crops other than cotton which are used for the same purposes as the Bengal jute. Practically the whole of this area is comprised of two crops, viz., Bimlipatam jute (known also as Deccan hemp), *Hibiscus cannabinus* and sunn or san hemp (*Crotalaria juncea*).

2. In most districts the former is found under cultivation where it is grown as a fibre crop for local consumption while at the same time the leaves are used as a vegetable and are considered an important item in the diet of the agricultural classes. The cultivation of sunn-hemp as a fibre crop is very localized from the fact that this is looked upon as the hereditary cultivation of the Janapars. Such centres are to be found in the Salem, South Arcot, Coimbatore, Tanjore and Tinnevelly districts. Sunn-hemp is also grown by fishermen in many districts along the coast as the fibre is held in high repute for the manufacture of nets. It is also very often sown in the Circars as a mixture in the ordinary dry land crops and the seed collected from such plants fetches a high price in the northern deltas where sunn-hemp follows paddy as a fodder and green manure crop.

3. As a commercial crop Hibiscus cannabinus is practically the only one grown and its cultivation as such is confined to the Northern Circars which account for about 95 per cent. of the area under fibre crops.

4. The following is the history of the experimental cultivation of jute (*Corchorus capsularis*) in the Madras Presidency :—

In 1905 at the suggestion of the Board of Agriculture of India, a trial cultivation of jute was made at the Samalkota Agricultural Station in the Gōdāvari district and for the purposes of comparison crops of Bimlipatam jute and of sunnhemp were also grown. These crops were given every chances of success. The land was well broken up by crowbarring and the requisite tilth was obtained by frequent ploughings and cross ploughings. Village cattle manure or "penta" was applied at the rate of 20 cart-loads per acre. The seed was sown from 1st—16th of May in successive sowings well in advance of the south-west monsoon. Germination was assisted by irrigation. The crop was given three weedings, and the requisite thinnings. The retting was very carefully done as shown by subsequent valuations which were from Rs. 10-8-0—Rs. 11 a maund. This price compared very favourably with the prices then ruling in Bengal. In spite however of the careful treatment given the yield of fibre per acre was less than 10 maunds per acre on the best grown plot; and the four trial plots averaged only 7 maunds per acre. The cost of cultivation averaged Rs. 112-3-0 per acre while the value of the crop was estimated to be Rs. 80. It was estimated however that on working on a field scale the cost of cultivation could be reduced to Rs. 68 and the yield was estimated

at Rs. 80. The cost of retting was an expensive item, viz., Rs. 40 per acre, but it was estimated that this could be reduced to Rs. 25. Even with these favourable estimates a profit of only Rs. 12 per acre was forecasted. This did not compare at all favourably with the red-stemmed variety of Bimlipatam jute, which was sold at Rs. 62 to the Chitivalasa Mills, though Calcutta valuations were only about Rs. 88 per acre. The trial crops of sunnhemp were even less profitable than was the Bengal jute. As the crop occupied the land at a season when it would otherwise be utilised for first crop paddy and as the first crop paddy is much more valuable than the second crop, trials were made in 1906 of sowing these fibre crops in October, November and December, *i.e.*, after the first crop paddy, but these were entirely unsuccessful and yielded on an average about 120 lb. of fibre. In 1907 April sowings were again tried, but the average acre yield was only 652 lb.; a sowing in May gave 357 lb. and in June one sowing failed altogether while the other yielded 866 lb. Trials were also made on the Agricultural Stations in Malabar and South Arcot. At about this time the Gōdāvari District Agricultural Association interested themselves in the cultivation of this crop and imported four jute cultivators from Bengal to instruct those, who wished to try jute, in the cultivation of this crop and in the retting of the fibre. Seven plots were grown in four different centres, but none of these were successful largely owing to the unsuitability of the land and to the lack of knowledge by these men of local conditions. Even the samples of fibre prepared by them were of very inferior quality.

5. In 1907 Mr. Finlow, the Fibre Expert of Eastern Bengal and Assam, visited this Presidency and expressed his view that the main deltas and the West Coast would probably suit the cultivation of this crop. Accordingly trials were made in the Tanjore delta through the aid of the agricultural association in that district and also in Malabar. Considerable trouble was taken with many of these plots but only where the fields had been liberally manured was there any real success and even this was very much below the Bengal average acre yields. Besides the question of manuring the difficulty in all cases, was in sowing the seed sufficiently early. Mr. Finlow remarked after his inspection in 1907 that the prospects of jute in Madras were decidedly hopeful. It is true that only one plot was really successful, but several others had been grown by people entirely unfamiliar with the crop. All the plots were stated to have been sown too late in the season, but with the uncertainty of early (April-May) rains this is inevitable as it is impossible to sow with certainty

earlier than June-July on the Tanjore delta and than May-June in South Malabar. It is true that rain does occur in these months, but only in irregular thunderstorms which are not frequent sufficiently to ensure the formation of a fine tilth and even germination. Trials were made on the Taliparamba Agricultural Station with jute and Bimlipatam jute as a post-monsoon crop. The jute was a failure and produced only about 1½ maunds of fibre. The Bimlipatam jute however gave a good yield of about 12 maunds per acre which was valued in Calcutta at Rs. 9 a maund. The trial cultivation of jute was continued on the Samalkota Agricultural Station till 1908 with no better results than formerly, while the increasing value of paddy made the prospects of its being introduced on to the delta more remote than ever.

6. The general conclusions arrived at may be summed up as follows :—

Bengal jute.—(1) There is great difficulty and uncertainty in getting a full stand if the crop is sown in April-May which is its proper season. On the deltas and the West Coast it cannot be sown later as when young the jute crop cannot stand excessive rain or flooding.

(2) The profits from its cultivation are very problematical even when prices are high and since these prices are subject to violent fluctuations its cultivation would be very speculative.

(3) The crop makes very heavy demands on the manure supply and it would on our deltas be impossible to provide for this. On the West Coast the soils are too poor ever to make the crop a success. In the trials made the only plots where it grew at all well was on the best double crop wet land.

(4) The crop matures at the time of harvest of the first paddy crop when labour is always scarce and it would be impossible to cope with this as well as the retting of jute at the same time.

Bimlipatam jute.—This crop is much more amenable to different soils and seasons and has given yields which show that there are possibilities of this as a commercial crop. It is however a crop which requires good drainage and is quite unsuitable for our heavy delta soils.

This crop makes much heavier demands on the manure supply than other commercial crops of the Presidency.

7. The prices for this fibre are higher in Madras than in Bengal, but since the markets are all in the north of the Presidency freights would seriously handicap the introduction of this as a commercial crop in the south where there

are no large contiguous areas where the cultivation could be introduced.

8. The following statement shows the distribution of fibre crops in the Madras Presidency :—

Statement showing distribution of fibre.

[Crops other than cotton.]

—	1907–08.	1908–09.	1909–10.	1910–11.	1911–12.	1912–13.	1913–14.
Vizagapatam ...	44,807	17,482	23,945	25,832	32,264	37,547	48,833
Gōdāvari	17,248	23,969	27,490	31,063	24,217	21,765	26,053
Kistna	48.880	34,399	37,741	38,230	50,712	34,732	32,061
Guntūr	28,573	22,848	117,931	124,781	142,435	173,469	171,181
Bellary	...	...	...	...	9,979	...	...
Madura	...	...	...	...	...	...	5,227
Malabar	...	...	...	...	6,175	6,789	8,184
Other districts whose total area does not exceed 5,000 acres.	18,001	15,849	16,483	19,028	13,955	16,406	16,645
Total for the Presidency.	157,509	114,547	223,590	238,934	279,737	290,708	308,184

SUMMARY OF THE DISCUSSION ON JUTE.

Mr. Chadwick opened discussion by saying that the department had hitherto done practically no work whatever on local (or Bimlipatam) jute, but that they had now an agricultural station in Vizagapatam district (Anakapalli) and they looked to this meeting to ascertain whether there was any general wish for them to attempt work on jute and if so on what lines it should be conducted and towards what objects. But before turning to this he would like to ask them whether they wished experiments to be once more made with Bengal jute. From time to time the department has been urged to make such trials and from time to time they have done so ; and they have not as yet succeeded in making it pay properly. Such jute must necessarily come into competition with paddy and the crops obtained in Samalkota and Malabar were not so large as to make it attractive to the cultivator.

Mr. Scott Mackenzie (South Indian Industrials) who knew some of the best jute districts of Bengal said that he knew of such trials being made and that he had no belief in the possibility of making Bengal jute a thoroughly

satisfactory crop in Madras. He would not recommend that such attempts be renewed at least at present. Mr. Wait (The Bombay Company) agreed entirely, and no one present advocated such trials or experiments.

This cleared the way to Bimlipatam jute. The Ongole or Kottapattam jute was much inferior to this in value. Mr. Wait explained the varieties of jute and the conditions which seemed to control quality and length of fibre. Of the two chief kinds, the red and green stemmed the former gave much better fibre. Both were grown mixed to a great extent as the leaves of the green stemmed jute were needed for curry. The conditions which controlled quality were, he said, season, method of cultivation and mode of retting. The first great requisite was length of fibre and it was no uncommon thing to see one part of a field well grown and another stunted; one field good the next bad. It seemed to him very largely to be a matter of planting, weeding and manuring; and what was required more than anything else was an improvement in the general standard of cultivation. Mr. Scott Mackenzie entirely agreed. Something might be done by plant selection; but, however good was the seed the whole crop could be ruined by indifferent cultivation.

It seemed therefore that nothing of much value could be done until it was possible to post a man to the jute areas which are largely comprised in the zamindaris of Bobbili and Vizianagram to inculcate into the ryots better systems of general cultivation. Mr. Wait further said that the dirty condition and dull colour of the Bimlipatam jute was often due either to short rainfall in the end of September and early October whereby the ryots soaked the fibre in pools of dirty water; or to excessive rainfall leading to bursting of the tanks, consequent waste of water and the use of stagnant pools for retting. Another drawback was that in the hopes of getting two crops from the land when the season was favourable the ryots were tempted to sow too early and harvest the crop too soon before it had obtained full maturity.

In regard to the jute which comes from Ongole side Mr. Scott Mackenzie remarked that it was invariably very inferior to Vizagapatam jute and it barely paid to buy it even when the price was Rs. 5 a candy lower. He could not be certain that it was the same plant but thought it was. The chief defect, however, was due to bad retting. The ryots around Ongole frequently soaked it in salt or brackish water which gives a sticky texture to the fibre, makes it darker in colour and renders it unsuitable for manufacturing into first class gunnies. The loss on treatment of this fibre in the

factory was sometimes so great that the coolies would not work it at the same piece rates as on good Vizagapatam jute.

There is also another fibre grown on the commercial scale in Gōdāvari district. This is hemp, not jute, and consists of two varieties black and white. The market for this is small. The former is the superior fibre and commands higher price, but the general value of the article is depreciated by the practice of mixing both kinds. This is done to some extent by the ryots but still more by middlemen.

In conclusion, Mr. Chadwick said he would like to ask the meeting whether they wished to have any statistics such as forecasts of crop collected. But he must warn them that chief jute area is comprised within zamindari limits from which as a rule it is very difficult to obtain at all reliable figures. In reply Mr. Wait and Mr. Scott Mackenzie both agreed that the collections of such forecasts were unnecessary. The area under jute was fairly compact and that they could very probably obtain better information as to the prospects of the season than could the Director of Agriculture.

VIII.—COCONUTS.

COMMITTEE ON COCONUTS.

December 16th, 1914—12 noon to 1 p.m.

Present :

The Hon'ble Mr. Ll. E. Buckley, I.C.S., *Chairman.*

1. Mr. J. Christie, Messrs. Peirce, Leslie & Co., Calicut.
2. Mr. W. K. M. Langley, Messrs. Peirce, Leslie & Co., Calicut.
3. Mr. E. H. Cooper, Messrs. Aspinwall & Co., Cochin.
4. W. A. Cross, Traffic Manager, South Indian Railway.
5. Mr. H. C. Sampson, Deputy Director of Agriculture, Southern Division.
6. Mr. G. R. Hilson, Deputy Director of Agriculture, Northern Division.
7. Mr. G. D. Mehta, Deputy Director of Agriculture, Central Division.
8. Mr. R. Thomas, Probationary Deputy Director of Agriculture.
9. Mr. W. H. Harrison, Government Agricultural Chemist.

AGENDA.

I. Should work be directed to a new plantation or trying to improve an existing one or both?

II. Are certain of the West Coast varieties considered to be superior to others and, if so, for what purposes, quality of oil content, copra, yield or coir, etc.

III. Should work then be directed towards improving quality, and if so which quality, or chiefly concentrated on yield.

IV. Are there openings for endeavouring to improve the local methods of preparation of coir, copra, desiccated coconut, oil and cake and, if so, on what lines?

V. Any suggestions or criticisms about diseases of the coconut and insect pests.

VI. Any other suggestions and criticisms.

NOTE ON COCONUTS.

So far the Agricultural Department has had no opportunity for doing any systematic work on this crop, but the question of opening an Agricultural station on this West Coast where this crop will be studied is being considered.

2. The following questions present themselves as necessary for investigation:—

Certain varieties are recognized by cultivators. Some are said to be more suitable for copra than others, for example, long nuts are said to have much more meat in them than the round nuts. It is generally understood also that there is no certainty that plants grown from nuts of a tree will produce trees of a similar type. Nuts saved from trees which produce long nuts, though they are said to produce a preponderance of trees bearing long nuts also produce trees which bear round nuts. Similarly the colour of nuts is not true to type. Variation therefore is probably a marked factor which has to be contended with. It is probable as recently hinted in Ceylon that the setting of nuts has a great deal to do with the regularity with which fresh inflorescences are formed and it is possible that by following up this line of investigation it may be possible to select parent trees whose progeny will be fairly true to type. It must however be several years before the results of any such investigation can be proved by results.

3. *Methods of cultivation Spacing.*—Experiments on this point appear hardly necessary as it is common knowledge that the plants want sufficient space to spread their leaves without overlapping.

4. *Cultivation and manuring.*—Here several points brought forward by varying local methods of cultivation require investigation. The basis of these seems to be largely the question of root pruning or rather the inducement of the plant to produce new roots. In some places it is the practice to dig a trench round the stem and to apply the manure there. In other places it is the practice to lower the soil level round the trunk of the tree well below the ground level. This is said to be done with a view to forcing the plants to develop a deeper root system. Again elsewhere the practice is to earth up round the base of the tree so that the plant can throw out new roots into this made soil. In Ceylon the gardens are said to be kept level and the manure spread over the whole area and dug in.

The question of manuring therefore is not simply a question of applying certain quantities of manure but also how these manures are to be applied.

5. At present our knowledge of manures for this crop is strictly limited. It is known that coconuts respond quickly to heavy application of manure and that the crop yield can be very greatly increased at considerable profit by such applications but whether other manures or the same manures would pay better in smaller or larger applications is not known.

6. The question of green manuring must also be kept in view. This has proved very successful in parts of the Gōdāvari delta and trials with such crops in conjunction with concentrated manures at our Agricultural stations, though not of an experimental nature, indicate considerable promise. For example, on the Central Agricultural station, Coimbatore, a double row of coconuts along an irrigation channel which had not been manured for several years, was in 1913 treated in the following way. The soil was dug up round the trees. 10 lb. of fish manure was applied to each tree and daincha was sown as a green manure and when 2 to 3 feet high was dug in. As a result of this the yield of nuts has very greatly increased. In 1913–14 these 48 trees yielded 506 nuts, *i.e.*, 10·5 nuts per tree. In the first six months of 1914–15 these same trees had already yielded 2,557 nuts or an average of 52·5 nuts per tree.

7. The question of the quality of copra apart from curing, *i.e.*, as far as it depends on the size of the nut may require investigation and it may be necessary to ascertain whether a fewer number of large nuts pay better than a larger number of small ones. This is a question which will have to be decided by thinning the young nuts in the same way that fruit are thinned to increase the size of those left.

8. Questions of manufacture, *i.e.*, drying copra, preparation of desiccated coconut, storage of ripe nuts are other problems which may have to be taken up.

9. The coconut trade is chiefly confined to the West Coast. South Canara, however, does very little export trade. In fact considerable quantities of nuts and copra are imported into the district from Malabar. A small export trade also exists from the deltas on the East Coast.

SUMMARY OF THE DISCUSSIONS ON COCONUT.

This discussion followed fairly closely the order detailed in the agenda. An interesting and suggestive letter of a practical nature was read from M.R.Ry. Vengayil Krishna Nayanar, Malabar district,

I. The committee was sounded as to the best course which should be adopted in opening up Government experimental plantations as no systematic work had as yet been undertaken on coconuts. It was generally agreed that it would be necessary for the department to work on newly formed plantations as well as on existing fully matured gardens. The firms' representatives reported that all good land suitable for coconut cultivation had already been taken up and that the department would probably experience some difficulty on this score. On this, Mr. Sampson said that he had already toured in South Canara with that object in view and was confident that ample land to suit departmental requirements might there be obtained. Mr. Sampson then stated that the idea was not so much to open a large central coconut plantation but rather have several separate plots subject to different conditions. Some of them would be in conjunction with a paddy farm. They would, of course, be periodically inspected and supervised by efficient men. Thus, two of these farms might be situated on the littoral sandy soil and two on the loam soil characteristic of the interior. These four would be new plantations. A fifth would comprise an old plantation which would be retained with the object of investigating insect pests and other diseases prevalent in the locality and how most efficiently to maintain and improve existing gardens. This would make a total of five small farms and should the necessity arise this number would be increased. The proposals outlined by Mr. Sampson were not seriously contested except that Mr. Langley strongly urged that some of these experimental plots must be in Malabar, the main coconut trade being centred between Tellicherry and Alleppey; and he advocated the neighbourhood of Beypore or of Kottayam.

II. It is well known that the products of the coconut industry exported from the Malabar coast are superior to those of a similar nature from any other part of the world and the market prices quoted are always in excess of those for produce from the Philipine Islands; Samoa, Fiji and Zanzibar. Messrs. Peirce, Leslie & Co., report, however, that the quality of the coir is fast deteriorating and suggested that measures should be adopted to arrest this. They attributed this general deterioration of quality chiefly to (*a*) indifferent soaking in brackish water, (*b*) digging up the husk before it has been properly soaked, and (*c*) to twisting yarn carelessly. These defects have been partially encouraged by the recent considerable increase in the demand for coir, but would tell economically whenever that demand slackened. Also this demand, and the consequent high prices ruling, has resulted in the

laying out of plantations on soils most unsuited for the coconut plant; little attention is there given to tillage and manuring is neglected; the plants are also grown much too closely in the gardens.

The Malabar variety is the best on the market both for quality of copra and fibre. Details as to the other varieties were not forthcoming. The Amalapur variety of the Gōdāvari tract appears to be in greatest demand on the east coast. When grown near the sea coast as in Narsapur taluk, the plants yield early but are short lived. When grown under conditions not quite so saline as in Amalapur taluk they take longer to mature and enjoy a longer life.

A large range of variety exists among coconut palms, such as early maturity, heavy yield, high percentages of water in the tender nut, also considerable variations in the size of the nut and percentage of kernel. It is not certain that palms always come true to type and these questions require investigation.

III. Messrs. Peirce, Leslie & Co., remarked that it was the quality only that needed investigating and that the quantity was sufficient for present needs and need not in consequence be considered of importance. Mr. Sampson was inclined to demur from this and considered that the present increasing demand showed that questions of yield were also of importance.

IV. The conditions which decide quality in the various products of the coconut palm were then considered.

(*a*) *Coir.*—Messrs. Peirce, Leslie & Co., report that the best quality fibre is *golden* colour, the second quality is *white* and the inferior quality is *black*. Soil apparently has a very marked effect in the colour of the fibre; not so much on the colour of the fibre before husking as after soaking and husking. In conducting this process of retting and husking the fibre appears to some extent to take the colour of the soil in the neighbourhood of which the husks are soaked; the common practice being to dig pits in the ground, add water and fill it with unhusked coconut. Under improved conditions of 'pitting' there is no reason why the quality of the fibre should not be considerably improved. Beypore yarn which formerly held a high place in the market has lost its position to a spread in the practice of using salt or brackish water for retting. The effect is to give a streaky yarn instead of one of even colour.

(*b*) *Copra.*—The best copra is always *sundried.* This gives the clearest oil. Less care than formerly is now bestowed on the drying of copra owing to its ready sale for all grades.

The *Malabar* variety was for many years the best in the world. Copra is exported in bags and both the oil and cake is lost to the country.

Desiccated coconut.—The demand for this product was so small that it was considered unnecessary to discuss it.

Oil and cake.—At present there is a small cottage industry in extracting oil by the ordinary country bullock mill; but the oil so produced is not generally useful for shipment. In Cochin however there are a large number of chuck mills worked by power which produced the white coconut oil so much in demand in Europe and America. Severe competition with Germany has been the rule for some time and it was suggested that attempts should be made to discover some means of assisting this local industry.

V. The most common diseases enumerated were those of bud-rot, coconut beetle (two varieties according to Mr. Vengayil Krishna Nayanar, Malabar) and to rats. The destructive effects of these were considered to be about equal in extent. Mr. Sampson, put forward the suggestion that the prevalence of bud-rot was very largely due to the unsuitability of soils on which the trees were grown. The destructive effects of the coconut beetle and of rats were emphasised by Mr. Krishna Nayanar in his note. Mr. Sampson called attention to the success of experiments at Coimbatore with tin or zinc plates attached on to the trunk as a preventive measure against attacks of rats.

VI. (*a*) In regard to the manuring of coconut many members of the committee considered this to be the greatest factor in determining the quality of the nut. Messrs. Pierce, Leslie reported that from their experience Kainit (potash manure) gave best results. Mr. Sampson referred the committee to the success of a mixture of green manure and fish manure when applied to coconut trees at Coimbatore as detailed in paragraph 6 of the note on coconut. It was also remarked that bone meal and nitre makes a suitable manure for coconut.

(*b*) Mr. Krishna Nayanar advocated the promotion of co-operative manure societies and the establishment of taluk manure depots for sale on cash and credit.

(*c*) He further stated that the manufacture of coconut jaggery was once an important industry on West Coast and suggested that attempts may be made to revive it.

(*d*) The attention of the railway representatives was called by the exporting firms to the fact that the largest

demand in the country were, for coir from Calcutta and for nuts from Bombay. Steamer freights had recently been raised and this was the common means of transport to date. The railways were asked to consider the question of reducing freight charges between the West Coast and Bombay and Calcutta.

IX.—TOBACCO.

COMMITTEE ON TOBACCO.

DECEMBER 16TH, 1914—1 TO 2 P.M.

Present:

MR. H. C. SAMPSON, B.Sc., Deputy Director of Agriculture, *Chairman.*

1. Mr. J. S. Manning, Messrs. Spencer & Co., Madras.
2. Mr. F. E. Hooper & } Messrs. McDowell & Co.,
3. Mr. J. Hermans, } Madras.
4. M.R.Ry. M. Subrahmanya Ayyar Avargal, Messrs. P. N. Ammaya Pillai & Co., Trichinopoly.
5. M.R.Ry. P. R. Rajagopala Mudaliyar Avargal, Messrs. Innes & Co., Cocanada.
6. M.R.Ry. C. Seshagiri Rao Garu, Kottapalli, Gōdāvari district.
7. Mr. G. R. Hilson, Deputy Director of Agriculture, Northern Division.
8. Mr. W. H. Harrison, Government Agricultural Chemist.
9. Mr. R. Thomas, Probationary Deputy Director of Agriculture.

AGENDA.

I. What are the chief defects of Indian tobaccos and are these attributable to bad varieties, indifferent cultivation, or neglect of insects attacking the leaf or bad curing?

II. Is it desirable to try and introduce a finer textured tobacco and is the prevalent coarse texture of Indian tobacco due to indifferent varieties or climatic and cultural conditions?

III. Can any useful work likely to be within the resources of the ryots be undertaken to improve the burning qualities of Indian tobacco?

IV. Is it necessary to try to investigate methods to combat loss caused by insects in tobacco after manufacture?

V. Is there a market for bye-products?

VI. Any other suggestions or criticisms?

SUMMARY OF THE DISCUSSIONS ON TOBACCO.

The discussion was of a very general character and but little attention was paid to the order of problems to be discussed as detailed in the Agenda. The Agricultural Department in the past had mostly with tobacco only made spasmodic experiments with exotics with little practical results and they wanted to ascertain whether there was any wish for them to try again and if so towards what objects their efforts could be best directed.

Mr. F. E. Hooper of Messrs. McDowell & Co. entered freely into the discussion and contributed very largely to its success by offering many useful suggestions and explaining the most important difficulties with which his firm as manufacturers had to contend.

Broadly speaking the discussion resolved itself into the following heads:—

(1) The advisability of introducing foreign varieties of tobacco.

(2) Improvement of indigenous varieties by

(*a*) suitable manuring;

(*b*) improved cultivation;

(*c*) growing on suitable soils and in a suitable climate;

(*d*) instructing the ryot in improved methods of curing;

(*e*) selection.

(3) The need of investigating methods of combating insect pests which affect tobacco after manufacture.

(4) Uses to which tobacco stalks and other bye-products might be put.

(1) Mr. Hooper emphasised the fact that at present efforts should be directed towards improving the indigenous types of tobacco—such work to involve an improvement in the quality of the "filler" leaf tobacco only. The introduction or the evolution of an improved "Wrapper" need not at the present juncture be contemplated.

(2) This view naturally led to the question of the means of improving the indigenous varieties of tobacco.

(*a*) Messrs. McDowell pointed out that different systems of manuring cause very marked differences in the quality of the leaf. Mr. Hooper further stated that their firm was always prepared to pay a higher price for better leaf but he questioned as to whether the ryot realised an enhanced price commensurate with that paid by the firm for leaf of superior quality. This state of things was entirely

due to the system of purchasing stock through middlemen who reaped the profits which he would perfer to see go to the ryot. Attempts had been made to deal direct with the ryot: but with no success. Messrs. McDowell stated that the manures they considered most suitable for tobacco were quicklime, saltpetre and ammonia. The presence of an abundance of potassium in an available form is beneficial to the crop but traces of chlorine are detrimental. They suggest that attempts may be made, by the aid of the department, to experiment upon ryots' lands with such manures. It was pointed out however that difficulties would arise in the curing, the sale and the testing of the small lots of tobacco grown under such experimental conditions. To surmount these difficulties both Messrs. McDowell and Messrs. Spencer made the sporting offer to purchase tobacco grown under such experimental manurial conditions to the value of Rs. 250 a year at whatever was the current market rate. Such co-operation from the firms would simplify the work of the departments in attempts to carry out such experimental work whether on Government Farms or on ryots' lands. In order to facilitate experimental work on ryots' lands a list of villages which specialised in tobacco growing was asked for. Those of importance in the Coimbatore district are given, viz., Vanikkarai, Therappudi, Kethampetti, Sangandampalaiyam, Nallagoundanpatti. Names of villages in other localities would be readily supplied by the various firms.

(*b*) It was agreed that at present but little could be done to improve the ordinary methods of cultivation adopted by the ryot.

(*c*) It is generally conceded that different soils will produce tobacco showing great variations in quality and quantity even when the same variety is grown. Thus Madura produces a characteristic black leaf suitable for cigar-making whereas in Guntūr a yellow leaf suitable for cigarette-making is the rule. These are two of the largest centres of tobacco production. In both localities the soil is heavy. Mr. Sampson was of the opinion that the soil best suited for tobacco of good quality is a light loam. The firms agreed and Mr. Sampson suggested that it was in localities where such soils were common that there were prospects of growing an improved type leaf. The difficulty here, however, is the question of irrigation as the amount of water necessary increases relative to the lightness of the soil. Mr. Sampson quoted an instance where considerable improvement had resulted in the quality of the leaf when introduced

into a tract where the soil was a typical light loam. As a result of his submitting samples from the locality in question to a manufacturing firm an agent was sent down who expressed his satisfaction and there is now a ready sale for the produce at a good price.

(*d*) It was considered impracticable for the department in its present state to undertake the work of teaching the ryot improved methods of curing tobacco.

(*e*) Practically no work has yet been done in this country on the improvement of tobacco strains by seed selection. The firms were of the opinion that this might offer good prospects of evolving improved strains. Considerable difficulty would, however, be experienced in curing the small quantities of leaves one would have to deal with under such experimental conditions; for fermentation is best conducted when the leaves are in bulk. It was suggested that this difficulty might be surmounted by suitably weighting the produce in an enclosed space but this would need preliminary investigation.

(3) There was a general complaint that the "puchi" (a weevil apparently) which attacks the leaf subsequently to curing is a most abominable and pernicious pest. It has baffled all attempts at destroying it without materially affecting the quality of the leaf. Mr. Fletcher (Government Entomologist) went to the extent of administering a treatment with hydrocyanic acid taking all due precautions; this also after trial was found impracticable. The firms require continued assistance from the department in investigating both preventive and remedial measures. This was the only serious pest quoted.

(4) In regard to the refuse matter in the form of stalk and the coarser midribs and leaf sheaths left after utilising that part of the plant necessary for making tobacco, many suggestions were put forward as to its possibilities. It was reported now that now it is more commonly used for the manufacture of snuff and chew tobacco. Messrs. McDowell reported that attempts had been made to manufacture tobacco from it but unfortunately had failed for the product gave a most vile odour. They further stated that nicotine had been extracted and that experiments might be made to test the suitability of the extract as a sheep dip and insecticide. Mr. Harrison (Government Agricultural Chemist) undertook to look up the modern methods of extracting nicotine.

Enquiries were also made as to its suitability for paper pulp.

X.—SUGAR.

COMMITTEE ON SUGAR.

DECEMBER 16TH, 1914—3 TO 4-30 P.M.

Present :

The Hon'ble Mr. Ll. E. BUCKLEY, I.C.S., *Chairman.*

1. Mr. W. Neilson, Messrs. Parry & Co., Madras.
2. Mr. F. G. Warbrook, Messrs. Massey & Co., Madras.
3. M.R.Ry. M. R. Mahadeva Ayyar Avargal, The AR. AR. SM. Sugar Mill, Tinnevelly.
4. Mr. A. Chatterton, C.I.E., Director of Industries and Commerce, Mysore.
5. M.R.Ry. Rao Bahadur C. Hanumanta Gowd, Hospet.
6. Rev. S. D. Bawden, American Baptist Telugu Mission, Kavali, Nellore district.
7. M.R.Ry. V. C. Velliangiri Gounder, Coimbatore.
8. ,, R. Sivarama Ayyar Avargal, Tinnevelly.
9. Mr. K. T. B. Tressler, Director of Industries, Madras.
10. M.R.Ry. J. Narayanamurti Garu, Personal Assistant to the Director of Industries, Madras.
11. Mr. D. T. Chadwick, Director of Agriculture.
12. Mr. H. C. Sampson, Deputy Director of Agriculture, Southern Division.
13. Mr. G. R. Hilson, Deputy Director of Agriculture, Northern Division.
14. Mr. R. C. Wood, Principal, Agricultural College, Coimbatore.
15. Mr. D. Mehta, Deputy Director of Agriculture, Central Division.
16. Mr. Thomas, Probationary Deputy Director of Agriculture.
17. Mr. A. F. Buchanan, Messrs. Parry & Co.

AGENDA.

I. In what respects is the jaggery which is now prepared whether from palm or cane defective, and how far is this due ?—

(*a*) to methods of extracting the juice,
(*b*) to the process of crude manufacture.

II. By what means can the trade and the department best assist each other in maintaining and extending our existing cane areas ?

III. Can advances on crops for manure be given or conditions of sale of cane altered, etc., to facilitate manufacture ?

IV. Are the qualities of the cane or palm in any particular localities deteriorating at present and, if so, in what directions ?

V. How can the statistical information now provided be made more useful ?

VI. Any other suggestions or criticisms for the improvement of production, manufacture or trade ?

VII. Are the conditions in Madras such as to render the manufacture of refined sugar profitable and, if not, what factors militate against it ?

NOTE ON SUGAR.

In Madras sugar is obtained either from the sugarcane or by the tapping of palms. The palmyra, the date palm and the coconut are all used for this purpose.

2. The ordinary form in which sugar is produced is as jaggery, *i.e.*, the result of boiling down the unfermented juice either of the cane or the palm until the mass is sufficiently concentrated to solidify on cooling. The jaggery therefore contains the whole of the sugar, *i.e.*, both the sucrose or crystallisable sugar and the glucose or uncrystallisable sugars. Refined or crystallised sugar is only manufactured on the factory scale and largely on account of the difficulty in disposing of the molasses this industry is very limited and appears to be only possible where the inverted sugar can be utilised in the manufacture of alcohol, and the bye-products which are formed in its production.

3. *Tapping.*—From the extreme south all up the East Coast to Vizagapatam district the palmyra is tapped for the manufacture of jaggery. In the Circars and Ceded Districts the date palm is also tapped while on the West Coast and to a certain extent in East Coast districts the coconut is tapped for sugar. The only attempt to organise tapping and to manufacture sugar commercially direct from the juice is the factory at Kulasekharapatnam belonging to the East India Distilleries Company.

4. The principal cane areas in Madras are not as one might expect in the irrigated tracts but in districts where the water-supply is limited. Our irrigated tracts grow paddy and the enormous quantities of water required for this crop exclude adequate drainage, except in localities where the natural drainage is sufficiently good to counteract this.

5. The total area under cane in Madras is estimated at about 87,000 acres and the following are the districts where the crop is of some importance :—

		Normal acreage.
Ganjām	... ...	5,109
Vizagapatam	... ...	24,168
Gōdāvari	... ...	6,214
Bellary	... ...	9,014
Chittoor	... ...	10,020
South Arcot	... ...	4,092
Coimbatore	... ...	8,049
Trichinopoly	... ...	7,699
South Canara	... ...	1,920
		76,285
	Other districts ...	10,679
	Total ...	86,964

6. In Ganjām the main variety grown is a thin white reed cane which matures in 8–9 months from the time of planting. Varieties have been introduced by the Agricultural department into the north of the district and when last seen gave promise of being successful.

In the south of this district a few varieties have of recent years found their way in from the Vizagapatam district.

7. The Vizagapatam district has the largest cane area in the Presidency and this represents about 30 per cent. of the total area under this crop.

8. The chief varieties here are the keli and the bonta which are grown in the south of the district and the reed cane, similar to that of Ganjām, which is grown in the north. Several importations of exotic varieties have been made in the past with a view to improving the industry. As far back as 1839 varieties were introduced from Mauritius and at a later date Messrs. Arbuthnot & Co., who owned a sugar factory at Chittavalasa, again attempted the introduction of Mauritius canes. These early introductions are reported to have failed though the varieties now grown contain one or two which seem to have been at some time or other introduced. In 1896 Mr. Gillman imported from Mauritius several

varieties of cane and one of these, the striped Mauritius, soon came into favour and this is now firmly established as one of the leading varieties grown in the district. Other varieties subsequently introduced by the Agricultural department have found some favour notably the Barbados seedling cane No. 208. In 1912-13 Government opened an agricultural station at Anakapalle partly with a view to improve the local cane cultivation. This crop in this district offers much scope for improvement. The cultivators are intelligent and industrious but can learn much of, and profit by improved, methods of cultivation and manuring. Much of the soil near the coast is an alluvial loam with free drainage and is admirably suited to cane cultivation.

9. *Gōdāvari.*—The cane area in this district is situated in the upland taluks and on the upper reaches of the delta where the drainage of the land is sufficiently good to grow cane. It is only within the last few years that this district has again come into prominence as a cane producing tract. Formerly cane was an important crop but at the end of last century disease (*collectotrichum fulcatum*) became rampant and the crop appeared to be doomed. It was entirely due to the introduction of the red Mauritius cane through the Samalkota Agricultural Station that cane cultivation revived. The following figures show how rapid the recovery was :—

Period.					Average acreage under cane.
1902—04	...	...	...	...	4,836
1905—07	...	...	..	...	6,150
1908—10		...	...	...	6,370
1911—13	...	...	...	...	8,570

The red Mauritius is now practically the only variety under cultivation on the delta and even this gets the disease if grown on land which is insufficiently drained.

Other promising varieties are under cultivation at the Samalkota Agricultural Station, but so far attempts to introduce these have failed to give uniform success nor does it seem possible that much further success will be achieved in this direction until the ryot realizes the importance of drainage.

10. *Bellary.*—Cane cultivation in this district is chiefly confined to the Hospet taluk on land commanded by the channels taken off from the Tungabhadra river. Here the indigenous methods of cane cultivation are good and the importance of drainage and also the value of green manuring are appreciated. The district has therefore shown a slow

but steady increase in the area under this crop as the following figures show :—

Period.	Average acreage under cane.
1902—04	8,801
1905—07	9,525
1908—10	8,904
1911—13	10,970

The main variety grown here is the keli which is similar to the Poovan of Coimbatore and the Pundia of Bombay and is one of the best thick canes grown in India.

11. *Chittoor.*—The cane cultivation in this district has never been investigated by this department.

12. *South Arcot.*—The area under cane in this district has fluctuated very considerably within recent years.

The area in Tirukkoyilur taluk dropped from 2,446 acres in 1900 to 395 acres in 1903 and during the same period the area in Kallakurichi taluk fell from 5,328 acres to 1,887 acres. In the Cuddalore taluk the area dropped from 986 acres in 1906 to 180 acres in 1908. With such alarming variations in crop area the East India Distilleries and Sugar Factories at Nellikuppam which had invested very considerable capital in cane-sugar manufacturing machinery realized the seriousness of the question of supplies to their factory. The question of supply was largely an economic one. The rise in price of food grains meant a great increase in the profits of paddy cultivation while since the prices of sugar were more governed by the world's supply no corresponding rise in price was evident. The only hope therefore of sustaining the cultivation of cane was by the introduction of better yielding varieties of cane and in this Mr. Neilson, the Manager of the factory, and the Agricultural department were able to co-operate and through the former's influence it was possible to introduce this red Mauritius cane which under trial at the Palur Agricultural Station and on land belonging to the factory had been found to be as equally suitable to South Arcot conditions as it was in the Gōdāvari. As a result cane cultivation began again to pay. In the Cuddalore taluk alone the area rose from 180 acres in 1908–09 to 1,605 acres in 1912--13. Now the local striped cane has been entirely superseded by the red Mauritius. In the Kallakurichi taluk where the Nanal or the reed cane is still cultivated, the area has not appreciably altered and this still ranges from 2,000 to 3,000 acres a year.

The spread of the Red Mauritius variety in South Arcot has been greatly facilitated by a change in policy by the East India Distilleries and Sugar Factories. Instead of

confining their attentions solely to the manufacture of sugar they are now interested in its cultivation and farm large areas of cane on land leased from owners and are thus able to guarantee a certain supply of cane to the factory independently of what private growers choose to bring in. In addition to this the factory have done much by their example to improve and modify the conditions under which the cane is grown. They offer every encouragement to cane growers to grow cane and even supply them with seed for planting and advance them manure for manuring their crops. Varietal trials on a field scale are now conducted by the company with promising varieties introduced by the department.

13. *Coimbatore.*—The area under cane in this district has steadily increased of late years as is shown by the following figures:—

Period.					Average annual acreage.
1902--04	...	...	...	...	7,807
1905--07	...	...	...	...	8,915
1908--10	...	...	...	...	* 10,279
1911--13	...	...	...	...	* 10,330

The chief varieties grown in this district are the Poovan, the Vellai and the Namam, all thick canes. Cane is chiefly grown under wells or under river channels and on the whole the cultivation is good. The district has an excellent market for its produce in the neighbouring country of Malabar and Cochin where the area under cane is a negligible quantity. Some of the better class of jaggery is exported to Bombay Presidency.

14. *Trichinopoly.*—The cane area in this district has remained practically stationary of late years as the following figures show:—

Period.					Average annual acreage.
1902—04	...	...	...	...	5,328
1905--07	...	...	...	...	5,574
1908—10	...		...	...	† 4,740
1911—13	...	...	...	...	† 5,861

The chief areas where cane are grown are the Perambalūr and Trichinopoly taluks. The cultivation is poor and little capital is put into the crop. Cane growers in Perambalūr have stated that the cultivation of this crop is no more

* For purposes of comparison the cane area of Karur taluk which from 1910 has been transferred to the Trichinopoly district are included.

† For purposes of comparison these figures exclude Karur and Namakal taluks which during the period were added to the Trichinopoly district.

expensive than that of paddy and this probably explains the fact that the area under this crop has shown no appreciable increase. There has been a marked decrease in the Karur taluk which fell from 2,036 acres in 1910-11 to 240 acres in 1913-14.

The chief varieties grown are the Namam, the reed cane or Nanal, and the red country cane. Red Mauritius has been introduced into a few villages in the Musiri division along the Cauvery valley which have been reported to have done well.

15. *South Canara.*—This district though not at present important as a cane growing centre has such possibilities that there is no reason why its value in this respect should not very considerably develop.

The rate of increase in area has been very marked in the last few years :—

Period.	Annual average acreage.
1902—04	1,158
1905—07	1,596
1908—10	1,852
1911—13	1,945

16. There are three varieties extensively grown, viz., the Namam, the Rastali and the thick red country cane. The department has done much last during the four years in improving the condition of this crop. Better and more economical methods of milling and manufacture have been introduced as well as better varieties of cane. The red Mauritius cane has taken a firm hold in the district and has proved admirably suited to West Coast conditions. Ten per cent. of the area under cane in the district is now of this variety. The work in this district has been rendered possible by the presence of an Agricultural station close by at Taliparamba.

17. *Introduction of improved methods of manufacture.*—The introduction of the iron sugar mill is one of the first records of agricultural improvement in the Madras Presidency. The first iron mills were introduced in 1882; and in 1892 a special census revealed that there were then 5,688 iron mills in use against 10,912 wooden ones. These latter have practically disappeared now as an agricultural implement, but for a few remaining in South Canara.

As already mentioned much has been done in South Canara to improve methods of manufacture and improved furnaces and boiling pans have been introduced. These have reduced the cost and burden of manufacture to such an extent

that it has greatly expanded the scope for cane cultivation. Work on much the same lines will probably have to be taken up in the Vizagapatam district where the quality of jaggery is notably inferior to that of the Gōdāvari district and usually fetches Rs. 5 a candy less on the market.

In the Coimbatore district there are now a few power mills in use and a trial central jaggery manufacturing station has been installed by the Director of Industries at Singanallur about which he writes as follows.

18. "Experiments have been made in this department with regard to improved methods of jaggery boiling. The work was started by Mr. Chatterton three years ago, but much preliminary experimental work was needed in order to determine the most suitable form of furnace. A type evolved by Mr. Chatterton has proved satisfactory. The advantages of the new system of crushing lie purely in greater rapidity of milling and in the complete saving of firewood. An acre of cane cultivation will yield from 20 to 30 tons of cane which, a 12″×18″ mill will deal with in a full day of two shifts. An ordinary country mill can crush a ton of cane in about six working hours, but making allowances for stoppages, etc., it seems improbable that not more than a ton and a quarter will be crushed per day. As is known, sugar deteriorates rapidly on keeping, and it is essential, therefore, to get it crushed as quickly as possible. One power mill will do the work of about 15 bullock mills and is always available; whereas it is sometimes extremely difficult during the harvest season to obtain the necessary animal power for crushing.

19. I have no statistics of the amount of firewood used in ordinary boiling; but I understand that it is considerable; whereas with the improved furnace the juice can be boiled off by merely burning the megass obtained after crushing.

20. These advantages are obviously very considerable. Against them has to be set the inherent disadvantage of all machinery involving considerable capital expenditure, viz., that unless it is kept in continuous operation the gross profit made, though considerable in itself, fails to cover fixed charges. Fixed charges are charges which have to be paid whether the mill is working or not and include interest, depreciation and the cost of expert supervision, if any is provided.

21. In general, a ryot would require little expert assistance. He will usually own an engine and if during the crushing season he makes his ordinary engine driver a special allowance that individual can probably be trusted to look after the plant.

During the season a clerk has also to be employed to check manufacture. These charges have to be incurred only during the actual working season which, so far as staff is concerned, may be assumed to last for four months. The capital cost of a crushing plant including a 12″ × 18″ mill and four sets of pans capable of dealing with 23 or 24 tons in an 18-hour day is about Rs. 10,000. Interest and depreciation on this sum may be allowed for at the rate of Rs. 1,200 annually. The pay of staff may be put at Rs. 40 a month; for four months Rs. 160. The total fixed charges are therefore nearly Rs. 1,400 annually. Daily running charges may be estimated as follows :—

	Labour.			Fuel.			Total.
	RS.	A.	P.	RS.	A.	P.	RS.
Two shifts (25 tons of cane) ...	13	8	0	6	8	0	20
One shift (12 tons of cane) ...	6	0	0	4	0	0	10

The yield of jaggery varies considerably with the variety of cane; but the yield of a full day's crushing at Singanallur was about 3,500 gallons of juice giving rather more than 6,000 lb. (230 maunds) of jaggery. On a single shift the capacity will be less than half this figure, but for purposes of rough approximation may be taken as half. At Singanallur the sum paid per podi (podi = 10 maunds) is Rs. 3, so that the earning power of the mill is Rs. 70 on a two-shift day and Rs. 35 on a single-shift day. The gross profit therefore is Rs. 50 and Rs. 25 a day respectively. It will thus be observed that the mill will pay its total annual fixed charges cost in 28 days two shifts crushing or 56 days single shift crushing; and any excess over this period represents so much clear profit.

22. These figures will not be realised in actual practice, because it is not to be expected that work will be carried on with such efficiency as that assumed. Making due allowance for ordinary wastage and inefficiency in working, I should say that the mill will pay in 40 days full crushing and 80 days single shift crushing. But this conclusion is again subject to modification according to the character of the crushing. I am quite convinced that if the work is done continuously for only 35 days or so, on double shifts the mill will cover cost. If, on the other hand, it works for one day double shift, is idle for two days, works for two days, and so on intermittently, the working cost will rise and the mill will not pay unless it does 45 or 50 days' full working. This is the trouble we have experienced at Singanallur. Again, the area under cane there is rather small and the position of the factory not particularly central. Consequently on account of the

limited acreage of cane one of the principal advantages of the power-crushing plant, viz., rapidity of work, has been somewhat discounted, and one of the principal disadvantages, viz., the necessity for regular adequate supplies has been much accentuated. Further, in Government work of this kind, there is always some wastage which could be avoided under private management. Nevertheless out of 107 days comprising the season the plant on 8 days' full work and 89 days' half work has shown a profit of Rs. 530, and this in spite of the fact that at the beginning of the season the improved furnaces were not ready ; about Rs. 40 had to be paid on extra labour and firewood which would have been saved had the improved furnaces been used throughout.

23. So far, I have dealt with the advantages of power crushing merely from the point of view of contract work. If a ryot crushes his own cane, he obtains a further benefit in that he gains the whole difference in cost between bullock and power milling and this sum is considerably higher than Rs. 3 a podi which ryots now pay for the conversion of cane into jaggery. Probably the Agricultural department know better than I do what is the actual cost of making jaggery by the ordinary bullock mill, but I understand that it varies between Rs. 4–8–0 and Rs. 6–8–0.

24. It seems to me evident that the case for power crushing is strong. At the same time, I am unable to endorse certain other claims made in its favour. From the reports received, I think it is evident that the jaggery made by the improved process is equal to, and in many cases superior to, that made in country mills; but extraction experiments do not indicate any material improvement in extraction by the power mills as compared with the country mills. It must, however, be remembered that country mill tests were made with the rollers properly set. I believe it is usual, on a long day's crushing when the bulls show signs of fatigue, to slack off the roller somewhat. If this is done, the extraction, of course, falls at once, and the power mill figures are better by 7½ to 12½ per cent. than those for country mills.

25. The average extraction at Singanallur was about 65 per cent., but varied considerably with the quality of cane. Regarding the quality of jaggery a series of analysis were kindly undertaken by the Agricultural Chemist, Coimbatore. These tests also showed considerable variation, but did not indicate any marked advantage in the power mill as compared with the country mill in respect of co-efficient of purity or prcentage of sucrose in the jaggery.

26. The question of the manufacture of refined sugar in Madras as a profitable business depends very much on the price of jaggery. Mr. Keatinge in a recent note to the Government of Bombay in which he discusses this question after having visited the sugar producing tracts of Hawaii, Formosa and Java, points out that with a purity of cane 85 per cent. which is greater than is usually procured in India even under factory conditions the manufacture of jaggery will still be more profitable as long as the price of this does not differ from that of refined sugar by more than 30 per cent. The average price of jaggery for the last 5 years has been 26·3 per cent. below the price of refined sugar. Thus there is still an average margin of 3·7 per cent. in the price favouring the manufacture of jaggery. This margin is, however, only for the average price of jaggery and not for the average price of cane jaggery which is considerably greater than that of palm jaggery. The direction therefore for the improvement in the sugar production of India clearly lies in improving the local methods of cane jaggery manufacture, which in many places is admittedly very crude.

27. The following statistical information as to the imports and exports of sugar and the internal movements of unrefined sugar and jaggery are quoted.

Internal movements of unrefined sugar and jaggery.

Imports into Madras Sea Ports from interior blocks other than sea ports :—

			Maunds.	Value.
				RS.
1908—09	...	...	412,250	19,82,000
1909—10	...	...	465,060	25,10,000
1910—11	...	...	367,000	22,40,000
1911—12	...	...	573,000	35,55,000
1912—13	...	...	612,000	34,67,000

Imports into interior blocks other than sea ports from blocks other than sea ports :—

			Maunds.	Value.
				RS.
1908—09	...	...	712,738	33,91,000
1909—10	...	...	673,000	37,67,000
1910—11	...	...	717,000	42,60,000
1911—12	...	...	628,000	36,50,000
1912—13	...	...	630,000	38,75,000

Sugar (refined, unrefined and Jaggery).

Year.	Imports. Quantity by sea.	Imports. Value.	Imports. Quantity by land.	Imports. Value.	Total. Quantity.	Total. Value.	Exports. Quantity by sea.	Exports. Value.	Exports. Quantity by land.	Exports. Value.	Total. Quantity.	Total. Value.
	CWT.	RS.	CWT.	RS.	CWT.	RS.	CWT.	RS.	CWT.	RS.	CWT.	RS.
1903-04 ..	2,14	15,15	96	6,75	3,10	21,90	1,94	8,31	6,00	31,00	7,94	39,31
1904-05 ...	1,38	8,29	1,04	8,25	2,42	16,54	1,99	12,44	5,25	34,50	7,24	46,94
1905-06 ..	48	3,51	1,32	10,50	1,80	14,01	2,10	12,86	5,00	27,00	7,10	39,86
1906-07 ..	1,60	10,72	1,50	11,25	3,10	21,97	1,57	7,15	5,10	27,00	6,67	34,15
1907-08 ...	79	5,84	1,80	12,00	2,59	17,84	1,95	9,64	6,40	34,00	8,35	43,64
1908-09 ...	2,59	16,03	2,20	16,50	4,79	32,53	1,73	9,79	4,60	27,00	6,43	36,79
1909-10 ..	4,28	28,18	1,50	13,00	5,78	41,18	1,20	7,44	4,80	31,00	6,00	38,44
1910-11 ...	4,41	33,64	2,20	18,00	6,61	51,64	1,69	11,32	6,10	40,50	7,79	51,82
1911-12 ..	3,57	33,16	1,40	11,25	4,97	44,41	1,68	10,27	7,30	49,50	8,98	59,77
1912-13 ..	6,78	62,63	1,90	15,00	8,63	77,63	2,77	19,65	6,20	42,50	8,97	62,15

Note.—Quantity in thousands of cwt. Value in thousands of rupees.

Statistics.—The only statistics published are forecasts of cultivation published on 15th September and 15th January each year.

SUMMARY OF THE DISCUSSION ON SUGAR.

The Committee confined itself almost entirely to the consideration of cane jaggery, cane sugar and cane cultivation. The peculiar difficulties attending the supply of palm jaggery such as the desertion by the Shanars of their hereditary calling, the heavy liming of the plots to prevent fermentation and the adulteration of the final product with sand to increase weight did not promise to afford a useful field for consideration.

There are many small differences, *e.g.*, in colour, shape, consistency in which jaggery has to be prepared to suit different local markets. The system on which the jaggery is made also varies greatly. It appears that in My sore professional boilers go round with mills and cattle and either buy up the whole crop or undertake to mill it at so much per maund. This last is a most pernicious system as if the cattle are tiring the men make little or no effort to extract all the juice. In Bellary Mr. Hilson said the ryots might hire the mill but they used their own bulls and themselves superintended extraction. In most parts of Madras the ryots use their own mills, pans and cattle. At times they may hire

mills but it was not thought that the Mysore system prevailed to any great extent in Madras. It was stated that sometimes in Mysore the ryots actually burnt the cane in the field because of a shortness of bullock power for crushing it.

This was not known to have occurred in Madras though it was admitted that when planting cane a ryot would consider what bullock power he had at his command for crushing it.

This led up to a discussion on the use of mills driven by power for extracting juice and arrangements for boiling the juice to jaggery in shallow pans so arranged as to economise fuel to the utmost. Mr. Chatterton described in some detail his latest type of jaggery furnace (Mysore Bulletin No. 21 of 1914), in which there are four sets of three pans in tiers. Each tier of pans is heated by one furnace in which no fire-wood is used but only dried megass. Last year he had spent Rs. 3,500 on firewood; but this year with the new type of furnace had spent nothing. An abstract of the work of such a furnace with average cane is as follows:—

The lower pan in which the jaggery is finally formed can be emptied every 1½ hours.

They can make 6,250 lb. of jaggery per day of 24 hours.

The engine is 12 horse power.

The mill is 12″ × 18″ rollers and can crush 1 to 1½ tons of cane per hour. Much depends on the skill of the men feeding canes into the mill.

The actual cost of making jaggery by this plant is As. 2 per maund of 25 lb.

Mr. Sivarama Ayyar expressed surprise at these results and wished to see this new plant at work. It cost the ryot in Tinnevelly As. 9 to make a maund of jaggery when following his old ways. It cost Mr. Sivarama Ayyar who followed newer processes As. 5–6 a maund, and apparently by this newer means this could be reduced to As. 2–9 a maund, Mr. Tressler gave the results of working this plant at Singanallur where they had been running for a month with only two furnaces and two sets of pans. In that time they had manufactured 94,261 lb. of jaggery without purchasing any fuel and the actual cost of manufacture was less than As. 2 a maund of 25 lb. This bore out Mr. Chatterton's figure. The plant is now working at Hospet in Bellary district. The minimum quantity of cane which it is necessary to crush in a season with such a plant to pay for manufacture and depreciation and interest is about 1,500 tons. Therefore with a crop

of 25 tons of cane to the acre it would be necessary to have 60 acres of cane within reach to make its use profitable.

This was on the assumption that the mill was owned and worked independently of the ryots who grew the cane. If the cane growers owned and controlled the mill all the profits due to its use would come to them. On an average they would get about 15 per cent. more juice extracted which would be equivalent to a rise in price from Rs. 1-8-0 to Rs. 1-11-0 and the whole of this extra profit had not been considered in the above calculation which was simply based on working expenses. There was no doubt that if the mill was worked by a number of ryots on a co-operative basis it would pay them to instal a 12″ × 18″ mill for as small an area as 40 acres. An 8″ × 8″ roller mill would deal with 10 tons of cane in 24 hours and he thought it would prove profitable to use such a plant for an area of 20 acres of cane. The cost of this smaller installation need not exceed Rs. 2,500 exclusive of buildings which were generally available.

Mr. Warbrook observed that the charges on the plant would be very largely reduced if something were done with the engine in the off season and in Mysore advice is given to attach rice hulling machinery to these sugarcane plants.

This brought on the question of a prolongation of the crushing season. Mr. Chatterton surmised that by arranging varieties of cane, times of planting, etc., it ought be possible to obtain an eight months' crushing season. None of the agriculturists however agreed with him so far as Madras was concerned. Dr. Barber had tried it at Samalkota without success and Mr. Neilson had done the same in South Arcot. The cane did not grow properly and the most they could do was to get a four months' crushing season from middle of February to the middle of May. In Coimbatore alone in Madras were there two distinct crushing seasons in the year. In Mysore it appeared clear that the crushing season is longer. Mr. Neilson said that in Java they were only able to crush for four months in the year.

Mr. Sivarama Ayyar described the chief hindrances to the spread of cane cultivation to—

(*a*) want of capital,

(*b*) the fall in price that so often occurred in the jaggery season.

This last is admittedly a great difficulty and no one was prepared to put forward any practical suggestion to meet it. In practice every one tries to dispose of his jaggery before the next monsoon.

Mr. Warbrook here asked whether it would not be as well to try and make sugar straight away from the juice. Mr. Neilson said that at Nellikuppam they did so but they also required jaggery for the other part of the year and they were distinctly interested to hear of plant such as Mr. Chatterton described. There were many problems before a sugar factory one of which was concentration of area and this in Southern India is a real difficulty. Mr. Chatterton said he hoped that the adoption of his power mill and jaggery furnace would lead to greater concentration of area without risking so much capital as would be required for a sugar factory; and that possibly from that attention might be turned to sugar.

As regards advances to ryots on crops to purchase manures or to grow better varieties of cane, Mr. Chadwick said this had been put on the list to draw attention to what was effected at Nellikuppam by Mr. Neilson to the advantage both of his firm and of the ryots, in case other manufacturers of jaggery or sugar on a larger scale might see their way to follow it. The Department of Agriculture introduced into South Arcot a new cane—Red Mauritius, the superior qualities of which Mr. Neilson recognised. Thereupon he went out of his way to do his best to *substitute* this cane for that which the ryots were growing and it was almost entirely due to his efforts that in that part of South Arcot the old cane had been entirely supplanted by this new variety. Not content with this he was now trying himself on a large scale every other variety which had done well on our farms to satisfy himself which really was the best for their conditions. Such class of work was of the greatest help to the Agricultural Department and they hoped that in time others might be able to see their way to do it. Mr. Neilson said he also made advances to the ryots against the crop for manure when necessary and said that the system was perfectly safe and made most enormous differences to the cultivator.

Mr. Neilson said that during the last three years the cane round Nellikuppam showed signs of deterioration. He did not think anything was actually wrong with it but the change of stock was probably desirable. Thus this year he had planted from some tops brought from Chingleput (same variety) and the crop had done excellently. In Java they brought some fresh tops to the plantations every year. It was probably not necessary to bring them from a great distance. The department undertook to look into this and if it became necessary to transport them from the West Coast. Mr. Cross said he would on hearing details of the proposal endeavour to expedite transhipment at Erode.

Mr. Sivarama Ayyar had so far no complaints against Red Mauritius which was the best cane he had yet seen but he had only been working it for two years. Mr. Sivarama Ayyar here asked to be supplied with all publications, etc., on sugarcane cultivation.

On the question of the manufacture of refined sugar in Southern India, Mr. Chatterton said he was emphatically of opinion that the better course was to deal with jaggery. He had no faith in these small one or two ton plants for sugar and said that a safe 1,000 acres of cane was the minimum required for sugar factory. They ought also to be able to make spirits from the molasses or at least as in Bombay mix it with the megass and sell it as cattle food. Mr. Neilson said that in Java they could afford to let the molasses run to waste in the streams. Mr. Sampson asked whether the conference was inclined to agree with Mr. Keatinge's statement quoted in paragraph 26 of the note, viz., that unless sugar was selling in India at more than 4/3 the price of jaggery it paid in India to make jaggery and not sugar. Mr. Chatterton thought that the margin in favour of jaggery was greater; but insisted that the big market in India was for jaggery and not for sugar.

Mr. Sivarama Ayyar said that it was generally taken that from 55 per cent. to 60 per cent. refined sugar could be obtained from jaggery. Thus with jaggery costing 10 pies a lb. to make the refined sugar extracted therefrom would cost As. 1-6 pies a lb. He understood Java could produce at As. 1 a lb.

Mr. Chadwick said this was about correct and gave some figures to show what great leeway had to be made up in India before conditions were at all similar to those in Java. By constant effort, Government intervention and control and from natural causes they were able in Java—

(1) to hire land suitable for cane at Rs. 40 an acre which was not possible in India, unless large extents of dry land are brought under well irrigation and worked by the owners thereof;

(2) on the average to get crops of 40 tons an acre of cane against our present average in Madras of 25 tons;

(3) on the average to get 10 per cent. of refined sugar from their cane whilst at Nellikuppam, Mr. Neilson said they could not get more than 9 per cent.

That is in Java they got four tons of refined sugar an acre from land the rent of which was only Rs. 40 a year; in Madras we could get $2\frac{1}{4}$ tons of refined sugar from the acre for which a rental of from Rs. 60 to Rs. 120 would have

to be paid. These bed rock figures had a most telling effect on the cost of production; and to these advantages Java added an excellent organisation. Again Java did not have such a long dry weather as India and was less subject to severe storms. The land too was extremely fertile. The immediate work seemed to be to endeavour to improve the varieties of cane, the total yield per acre and by cheapening the cost of manufacturing jaggery to centralise and expand cultivation in areas where rents are low.

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